

On the Possibility of Byzantine Velvets.

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The origin of the woven velvet structure is one of the outstanding mysteries in textiles studies. Although surviving Byzantine silk examples do not seem to include velvet, some Arabic sources suggest that the technique existed in the Eastern Mediterranean, possibly as a Byzantine textile, as early as the eighth century. Linen velvet fragments found in Egypt have been dated between the third and the sixth centuries, encompassing the periods of Late Roman and Byzantine rule there. It is therefore pertinent to examine the merits of this suggestive evidence regarding the development of velvet-weaving.

The term *velvet* is here defined as a supplementary warp pile structure, in which a perpendicular pile surface is formed by periodically raising a set of warp threads over a rod above a foundation cloth structure and securing them into that foundation (Fig. 1a). (Appendix A is a glossary of weaving terms used in this paper). Velvet is one of several pile structures which may be achieved by weaving, knotting or embroidery techniques (Figs 1b &c), but it is the quickest technique by which to produce an even, dense but remarkably supple pile surface, especially using finer, lighter threads. It may be considered a mass production technique for pile textiles of the first millennium, for clothing, toweling, and furnishing fabrics. *Velvet* refers both to the woven structure, to textiles woven with this structure, and to the particular techniques of weaving it.¹ More generally, non-specialist usage treats the term velvet as an umbrella term for pile textiles (apart from carpeting), as well as a descriptor of soft fuzzy textures formed by tiny projecting hairs. Research of historical warp velvets is frequently impeded by imprecise descriptive and metaphorical usages of velvet terms in most of the languages and scholarship encountered – Latin, Greek, Arabic, French, Italian, as well as English.

Examining the velvet weaving technique for the Coptic and Byzantine contexts will extend our understanding of the weaving technology of the period and explain the existence of several surviving textile fragments. Unlike the other woven structures known for the time, velvet weaving requires two independent systems of storing and tensioning warp threads on the loom. The height of the finished pile requires a considerably longer warp than does the foundation cloth. This long pile warp must be stored in such a fashion as not to slow the weaving process unduly or not to become entangled, and it must feed forward at a different rate and a lighter tension than does the foundation warp. The ramifications of such weaving requirements have not been addressed by nearly all publications about Eastern Mediterranean or Byzantine textiles (some of which contain these linen velvets in their collections) including those which acknowledge the importance of technical and practical aspects.²

Despite the paucity of extant Byzantine textile fragments and the larger group of textiles commonly called "Coptic" from Egyptian burial sites, a tiny handful of textiles exhibiting warp velvet structure have survived to raise the questions of how and why they may have been made. I have located 10 fragments so far, six of which may be readily seen in the study collection at the Victoria and Albert Museum in London, whose features and labels identify them as velvets. These fragments are executed in linen warp pile on a linen foundation cloth, using the same type of fine single ply linen found in Coptic plain weave garments. Some fragments have inset tapestry motifs woven at the same time as the whole textile. Clearly the makers of such textiles were resolving the requisite special technical problems described above, as well as those problems occasioned by incorporating tapestry techniques into the

¹ In French, the term *velours* encompasses both warp and weft types of woven pile. Anglophone usage has adopted the term *velours* to describe various contemporary pseudo-velvets, especially those with a knit foundation cloth. For clarity, I will occasionally specify warp velvet.

² Kendrick (1920-22) contains 6 examples of velvet but does not identify them as such. Scholars taking this approach include: Muthesius (1997), Lafontaine-Dosogne (1988), and to a lesser extent, Carroll (1986) and Trilling (1982). Only Bellinger includes the linen velvets of Egyptian finds in a discussion of weaving techniques specific to this period, briefly in a Museum technical paper. Vial (1987) and Souday (2000) also acknowledge the linen velvet technique for this period, as minor background to another topic.

unusual warp set-up. How they did so, and how this may have related to other known textile structures or the development of weaving ideas or equipment such as the drawloom, has not yet been fully examined. Doing so will greatly expand our understanding of textile history and the technology ascribed to the Coptic and Byzantine contexts.

Historically, velvets are most typically thought of as silk textiles, as developed consistently from at least the twelfth century in northern Italian cities (Monnas 1986). Clearly questions arise as to where and when silk velvet began to be made, and to what extent the development of silk velvet can be connected to the earlier linen velvets or to knotted silk pile carpets. Could the development of silk velvet be related to other known Byzantine weave structures, such as the compound tabbies and twills? What conditions contributed to its appeal and led to its subsequent development in northern Italian centres, especially in Lucca, Florence (possibly since 1187), and eventually in Venice?

No velvets or comparable pile fabrics appear to have been identified for the surviving body of fabrics and techniques known as Byzantine (eg. Muthesius 1997). However, a few vague documentary references suggest that the structure may have been in development within or adjacent to the Byzantine Empire at an early date. The empire's extensive commercial and diplomatic activities may have been the environment that enabled the technique to thrive in northern Italy and Asia Minor, whence it seems to have spread throughout the world. Egypt, for all its distance and cultural distinctions from Constantinople, was under Late Roman and Byzantine control into the seventh century, and regularly exported linen textiles and possibly technical ideas into the heart of Byzantium, as did Syrian cities from which both linen textiles and silks were obtained. As we shall see, a few Arabic sources suggest that silk velvets may have been Byzantine at least as early as the tenth century, and was possibly known earlier. This paper will consider what light can be shed on these questions regarding the possible origin of velvet-weaving in Byzantium and Late Roman/Byzantine Egypt.

The Written Evidence

Much of the scholarship about Byzantine textiles concentrates on the silk industry and the roles of silk in society and diplomatic exchange for very good reasons but to the detriment of our understanding of the contemporaneous wool and linen production. Silk textiles are the primary group of distinctly Byzantine textiles that have survived to the present day. The silk industry, both production and consumption, was subject to greater state regulation than other textiles, due to the costliness and rarity of silk and purple dye, and certain restrictions to Imperial use. The elaborate beauty, preciousness, and Imperial associations of silks excited more descriptive comment by writers than did other textiles. Most surviving examples have been those bearing figured patterns or inscriptions, whose survival depended upon special circumstances of preservation in the treasuries of courts, Churches or monasteries of Europe. These silk examples differ markedly from the many textiles excavated from the burial grounds of Egypt, variously called Late Roman, Late Antique, or Coptic. Rarely are these Coptic textiles related to the group called Byzantine, because the Coptic textiles are primarily executed in linen and/or wool, and their woven structures are primarily variations of plain weave and tapestry techniques (Fig.2a), as well as weft-looped pile (Figs. 1b&c). However, the same plain or tabby weaves, tapestry, and twill weaves continued to exist in Byzantium alongside the weft-faced compound tabby and twill weaves, the twill damasks (Figs.2b-e) and the lampas weaves (Muthesius 1997). More or less elaborate overall figuration using the loom-controlled compound, damask, or lampas weaves could be woven more quickly and evenly than tapestry. They could also be executed more consistently and rapidly than embroidery for all but the smaller items, thus providing certain economies that were advantageous for large scale production of elaborately figured fabrics in light, delicate, silk and gold threads.

As Trilling (1982) argues, boundaries between Coptic and Byzantine textiles may not be easily distinguishable, if at all.³ The plainer, simpler cloths of Byzantium would have been woven in materials and techniques of modest cost and skill, and used for a variety of everyday clothing and household needs, as well as such practical needs as shipping cargo, strapping, and military tents. These everyday conditions and purposes were arguably very similar for the majority of people in both Egypt and other parts of Byzantium, as well as many of its near neighbours. Without denying the probable existence of subtle local variations and fashion preferences, it is generally accepted that the textiles found in Egypt are strongly representative of textiles known throughout the Eastern Mediterranean over a considerable period of the first millennium (Trilling, 1982; Bellinger 1950-52).

However, Coptic and Byzantine groups of textiles share a number of features that show they cannot be easily distinguished by era, region or technique. Some of the most typical elements of shape and decorative design of Coptic garments described by Carroll (1988) and others, and exemplified by existing textiles, may be seen in the Byzantine garments depicted in the mosaic panels (Fig. 3) of San Vitale, Ravenna (540s). In the sanctuary panel depicting the Emperor Justinian, we can just see beneath his cloak a round shoulder motif on the left shoulder, and rising from the short hem of his tunic, a vertical band of décor capped by a pointed leaf shape (Cormack 2000, pl. 33). In the companion sanctuary panel depicting the Empress Theodora and her party (540s), the slightly-visible tunic of the man to her left shows a square shoulder patch and another square motif at knee height (Cormack 2000, pl. 34). The dress of the woman to her right has two elaborate vertical bands, and those of the next two women show round and square motifs respectively near the hem, about midway below the knee, on top of elaborately patterned cloth. At least one of the women's shawls shows an eight-pointed star shaped motif. Another sixth century wall painting in Antinoë of the Lady Theodosia depicts more clearly the garment decoration (Fig. 4). These mid-sixth depictions correspond closely with the range of Egyptian tunic and shawl decoration ranging at least between the third and eighth centuries, as confirmed by the surviving Egyptian-found textiles (Fig. 4).⁴ This similarity cannot be fully explained by imports coming into Egypt, although it appears that various textiles were entering Egypt from Byzantine Asia Minor and Anatolia (Stauffer 1995; Trilling 1982; Bellinger 1950).

Like other Late Roman provinces, Egypt was subject to the price edict of Diocletian (ca. 301). Throughout the extensive linen listings in the edict, Tarsican-type linens from Alexandria appear as a standard sub-category, (Giacchero 1974, §26). The listing of maximum shipping fees indicates that goods from Alexandria, and presumably other Egyptian centres, were being exported widely throughout the Late Roman empire, including Byzantium, Thessalonica, and Rome (Giacchero 1974, §35). Textiles, principally linens, were the only Egyptian product produced in sufficient excess to export during Late Antiquity (Bagnall 1993). As dating for textiles of this period is extremely rough and the textiles remain very similar in most features, it is reasonable to speak of these Egyptian-found textiles, from the beginning of the fourth century to the early seventh century (when the Byzantine empire lost Egypt to Arabian invaders) as early Byzantine, and probably representative of the range of non-silk textiles circulating throughout Byzantium and the Eastern Mediterranean.

Correspondence among the more modest types of Byzantine textiles, about which we have little contemporaneous information apart from the surviving examples, may be especially true for the technical levels of weaving because the various ways of executing the basic structures are limited by the

³ Other scholars make a similar point, especially Bellinger (1950-52) Lafontaine-Dosogne (1988), but the ways in which textiles have become categorized as Byzantine or Coptic leave a false impression of clear distinctions which are likely more technical than regional or cultural.

⁴ The numerous collection catalogues consulted are listed in the references cited.

available weaving technology. This technology constrains the diversity of looms and weaving techniques, whose features may be partially extrapolated from extant fragments and technical understandings of weaving. Nevertheless, the range of possible techniques and equipment should not be too narrowly construed, because theoretically several equally simple methods may produce a given structure. Each method has advantages and disadvantages that weavers balance to achieve economic viability within the prevailing local circumstances and conventions. Furthermore, the Code of Justinian shows that artisans were legally bound to the craft of their parents, usually their father, as well as to their town of origin in the early Byzantine period.⁵ Generally, these provisions would have favoured an enduring overall stability in weaving practices and regional specialization and slowed the diffusion of new techniques.

Experimental archaeology is helpful in examining questions of how textiles may have been made and assessing their viability and likelihood, as de Jonghe and Tavernier (1983) showed with respect to explaining the phenomenon of crossed warp threads in Coptic tapestries. Hoskins (1992) wove comparative samples to argue that some decorative bands of Tutankhamun's tunic were woven as weft-faced rather than warp-faced bands. Without overlooking the problems posed by the limited written and artefactual evidence, and the speculative nature of experimental archaeology, sampling linked to procedural analysis of the processes and implied equipment offers an effective means of deepening our understanding of Byzantine textiles beyond what the extant evidence can provide.

Muthesius (1995, 1997) endorses a multidisciplinary approach to the study of Byzantine silk textiles, which gives considerable weight to technical and practical aspects of producing textiles, and presumably to experimental verification of technological assertions. She skillfully incorporates a good understanding of aspects of the weaving process into her historical interpretations and case studies of particular artefacts. Nevertheless, Muthesius misses some deeper insights into the links between product, process, and economics that experimental sampling and analysis by an experienced weaver can add. This weakens her discussion of the possible meaning of uncertain terms, such as *polymiton* or *dekalia* (Muthesius 1995). She does not follow up on all the implications of weave structures for the equipment – questions of tensioning systems or the range of available looms, for example – or the economics of labour organization among the various weaving processes. Her connections between basic tabby and twill, and compound weft-faced weaves based on them, do not appear to extend much past classification to address the implications of the pattern orders of threads that create structure and guide loom set-up and weaving sequences. She discusses briefly an elaborated drawloom lifting mechanism but not the warp tensioning system, or the relation between the potential warp length capacity and the size of looms and weaving/workshop spaces. Also, she does not position silk weaving within the fuller spectrum of Byzantine textile culture (except in social status), by comparing them to what might be deduced about plainer linen and wool textiles. Nevertheless, although the discussion can and should be expanded to encompass additional facets of practice and thus provide possibly stronger interpretations, such interpretations remain speculative and inconclusive in the absence of contemporaneous artefactual and written evidence.

Carroll's (1988) discussion of the Coptic technology is also weak in linking textile structures to weaving methods and equipment, although she provides a good concise introduction to the technology, the evidence, and the social context. She indicates that both vertical two fixed-beam (Fig.5b) and horizontal loom types were likely in operation simultaneously, but does not suggest alternate or hybrid

⁵ Code of Justinian, Book IV, § LVIV.5 indicates that those "skilled in certain trades", both state-owned slaves and freeborn, had to "remain in their respective towns" (Scott 1973, vol 13, 290). Book XI, § VII.11, .12, and .15 indicate that at least some skilled occupations were hereditary, with specific mention of weavers and dyers (vol. 15, 172-3).

forms.⁶ Trilling (1982) also says little about technology or structure, but the context he supplies acknowledges a long-term stability and continuity between Late Roman and early Byzantine textiles in Late Antique textiles found in Egypt that supports my argument for enduring and similar technologies. In addition, his catalogue contains two fifth century (presumably) drawloom-woven covers (cat. nos. 109 & 110) made of wool with long, weft-inserted pile on the backside, a remarkable combination not evident among the extensive Byzantine textile listings of Muthesius, which focus on silks. Wild (1987) proposes the existence of an early Roman horizontal loom (Fig.6) with rising pattern heddle rods but without superstructure, foot treadles or spacing reed (basically a vertical 2-fixed beam loom turned horizontally), which would be suitable for the production of tabby, twill, and twill damask weaves.⁷ He further cites a proposal by de Jonghe & Tavernier for a method of storing more complex pattern sheds for future reuse (Wild 1987) that would speed up weaving. Such a storage method only requires that the pattern be carefully picked-up initially once and retained on auxiliary shed rods or cords, while the basic and oft-repeated foundational weaving structure is executed by lifting heddle rods.⁸ Such a technical idea constitutes an early step in the development of drawlooms: including the counterbalanced shaft loom operated by overhead pulleys and foot treadles (Lafontaine-Dosogne 1988, fig. 140), the two-harness system described by El-Homossani (1985) for Egyptian weft-faced compound and *dibaj* weaves, and the more elaborate individual thread lifting mechanism of the Byzantine drawloom described by Muthesius (1997).

Lafontaine-Dosogne's (1988) catalogue, *Textiles Coptes*, offers an excellent but extremely concise technical introduction by D. de Jonghe, with excellent illustrations which are especially useful to specialists with prior weaving knowledge. The discussion of the loop techniques is limited to weft-looping, but the discussion of loom technologies is the only one to propose a counter-balanced heddle rod system (Fig. 140), and relate it to the developments in drawlooms and weft-faced compound weaves. De Jonghe and Tavernier (1983) expand on this technical detail in their study of the phenomenon of crossed warp threads in inset Coptic tapestry work. However, neither of these works mentions warp-velvet piles for the period, although many of the extant fragments they discuss derive from the same place (Akhmîm) and periods as the linen warp-velvets in the Victoria and Albert Museum. The same is true of de Bourguet's (1964) catalogue of the Louvre collection of Coptic textiles, although one fifth century example (B5) is described as *bouclé* (looped) rather than *bouclé à la trame* (weft-looped). Bourgon-Amir's catalogue for the Musée Historique des Tissus, Lyon, baldly captions a single example (24400/118) as warp velvet without further detail.

Other Byzantine researchers concentrate primarily on socio-economic aspects of silk production. Lopez (1945) provides little discussion of the detailed relationship between weaving process organization and economics. Neither does Jacoby (1991), who concentrates primarily on provincial Calabrian and Greek contexts of the silk industry beginning in the ninth century, and the removal of highly skilled Corinthian weavers to Sicily by the Normans. Maniatis (1999) takes seriously the importance of considering practical details of the textile processes in assessing commercial viability and decision-making, but he concentrates on the commercial perspective and does not examine the

⁶ Alternate set-ups might resemble such latter traditional looms as the Palestinian 3 fixed beam vertical tapestry loom discussed by Brody (1979), and especially the Eastern warp-weighted looms (Brody 1979; El-Homossani 1985; Roth 1978/1913; and esp. Wulff 1966).

⁷ Wild (1987) agrees with a proposal by de Jonghe and Tavernier for the use of a horizontal loom with significant tensioning capacity. I have not seen the article by de Jonghe & Tavernier that Wild refers to.

⁸ A similar principle of stored picked-up pattern sheds combined with simpler foundational weaving heddles or shafts is currently practiced by traditional Laotian weavers, and is incorporated in a different manner into the heddle-lifting mechanism of the Asian "swine-basket" loom.

technology or types of weaving to the detailed degree that Muthesius, Wild, Carroll or Dosogne (in her diagrams) do. Lombard's (1978) outline of the broad context of textiles in the Islamic world is relevant to the Byzantine context, because early Islamic territories in Egypt, Syria, and Asia Minor were frequently formerly Byzantine territories. They shared to some extent the Graeco-Roman legacy as well as many everyday characteristics of rural and urban life, commerce, and production, especially as they relate to the relative technological and socio-cultural (rather than economic) stability of textiles culture. However, despite Lombard's occasional mention of velvet in source quotations, he does not discuss them as types, as he does for other frequently mentioned types, any more than does Sergeant (1972) in his work on Islamic textiles.

The specialist technical and historical textile literature is more helpfully detailed for those attempting to reconstruct the technologies and relate them to their social context. In addition to de Jonghe and Tavernier's contributions already mentioned, Brody (1979), following Wulff (1966), describes several Eastern loom set-ups for Palestine, Syria, and Persia which have long warps weighted at the back, or drawn from the back and over behind the head of the weaver. El-Homossani (1985) shows a similar set-up for Egyptian weft-faced compound twills. All these sources indicate that the independent tensioning principle necessary for velvet may well have been available to weavers throughout the Eastern Mediterranean from at least the early Byzantine period. The arrangement of the warp lifting orders of weft-faced compound weaves illustrated by El-Homossani (1985) is remarkably similar to that of velvet structures. Although the use of the two-harness set-up is not necessary for velvet surface texture, especially for the overall texture of the early Egyptian linen examples, the later developments of figured silk velvets may have been simplified with a similar two-harness set-up.⁹ Bellinger's knowledgeable technical papers (1950-1959) briefly discuss technical characteristics of the warp velvets (1955), raising several points about equipment, tensioning and weaving practices that must be addressed, or verified by experiment. She considers the ordering of warp threads in the lifting mechanisms as a weaver would (1952), and traces its developments towards the drawloom. However, her technical interpretation is brief and sometimes too narrow, and does not assess other possible methods.

It is not surprising that Byzantine scholars may have overlooked the possible existence of velvet, as Byzantine written sources pay little attention to textural features; colour, light (as in the shine of smooth silk, gold, and jewels), imagery, and preciousness or costliness are the characteristics which excite comment. No obvious terms describing velvets or pile fabrics seem to emerge. However, examining the lexicon of Latin and Greek suggest what terms to look for.

Briefly, a variety of medieval Latin terms refer to velvet, especially but perhaps not exclusively silk warp velvets: *vellus*, *veluel*, *veluso*, *velluetum*, *vellutum*, *velluvium*, *vellonus*, and *velotum*, to name a few variants (Du Cange 1887). All of these relate to the Latin terms *villosa*, *villosus*, *villusus*, which mean hairy or shaggy, and to *vellus*, *velleris*, which refer to fleece, pelt, wool, or hair (on skin), or to fleecy texture; they also relate to *vellum*, which is skin (leather). In addition, the Latin *pellicula* refers to skin or fleece, and *pellus* refers to skin or hide, as well as felt. The term *flocus* (var. *floccus*, *floccosa*, etc), meaning tuft of wool or hair, also describes pile textures, especially for textiles (Du Cange 1887). The modern English and French terms – velvet/*velours*, pile/*poil*, plush/*peluche*, and flock(ed)/*flocon* – strongly retain the referential logic inherent in its linguistic roots traced from early Latin references to the skin hair (fleece or fur) of animals and humans. Also largely retained is the predominance of the textural aesthetic meaning over the more specialized structural distinctions of textile makers, suggesting that the structures came to be named for the texture, and not the reverse. Clear identification of warp velvet structure in written sources is usually impossible because of the wide-spread ambiguity of lexical

⁹ I have not yet investigated this idea.

reference and metaphor, in the early period under discussion as well as in contemporary languages including English. Several distinct textile structures or processes may produce a pile texture or appearance that can be described as velvet or velvety.

Tracing a similar logic in Greek reveals terms that may have referred (with equivalent ambiguity) to pile textures; for convenience, they are summarized here as a synthesis from several dictionaries and glossaries.¹⁰ The Greek terms related to hair (on skin or of animals) and hairy (shaggy) include: *trichoma* (τριχομα), *trichotos* (τριχοτος), and *trichodes* (τριχωδης). Variants of the term *mallos* (μαλλος) refer to fleece or wool, with *mallinos* (μαλλινος) translated as woollen. *Trichomallos* (τριχομαλλος) is translated as fleecy. The terms *trixa* (τριξα) referring to hair, bristle, fur or the coats of animals, and *thrix* (θριξ) meaning wool, hair, or bristle are also related, as is evident in their sounds. The term *pelos* (πηλος, πελος) refers to pile or the nap of cloth. *Pilos* (πιλος) refers to felt and felted articles, and *pilesis* (πιλησις) refers to the compression of wool or felt, or the felters' craft; technically these meanings are distinct from woven piles, although usage may not be so strict. Another set of Greek terms which may be related to velvet or pile includes *belos* (βελος) meaning dart, *belona* (βελονα) meaning needle or pin, *belone* (βελονη) meaning needle or point of an arrow, and *beloulkia* (βελουλκια) meaning the drawing out of darts. More clearly pertinent to pile textiles are: *belon* or *belone* (βελον, βελονη) equated with the Latin *velum*, *belikaton* (βελικατον) equated with the Latin *pellicatum*, and *beloudon* (βελουδον) equated specifically to the Latin *villosus pannus* (*pannus* = piece of cloth) by Du Cange (1958/1688). He describes *beludeni* (βελυδενι) specifically as "*villosus, τριχωθεισ*" (187). It is noteworthy that the Latin *pellacia* (attraction), *pellax/pellacis* (seductive), and *pellicio* (to entice) share the same root stem as terms related to fur or skins. Du Cange equates *belikaton* to *pellicatum*, rooted in concepts of needles, sharp points or darts and of darts drawn outwards as well as animal fur, hair, and bristles. So *belikaton* / *pellicatum* may be used in the sense of attractive or enticing, through the sense of drawing towards, and not name an actual pile textile.

The phonetic similarity of these classical or medieval Greek terms to the contemporary Greek term for velvet, *beloudo* (βελουδο), may be supported by an argument built on a metaphorical logic to small points drawn out and projecting from a surface, which accurately describes the technical and structural relationship of pile to foundation cloth, in addition to the appearance. This argument rooted in Greek etymology is an alternative to the suggestion that the Greek *beloudo* is a derivative of the Latin *vellutum*; in other words, is merely a Greek name for a textile of foreign origin. The meaning may have gone from Greek to Latin as much as from Latin to Greek, or emerged simultaneously. Finally, Oikonomidēs (1990) reports the medieval term *belesikon* (βελεσικον) as referring to a cover or blanket imitating animal fur. This seems to be an oral corruption into *berous* (βηρους) of the Greek *theros* or *therion* (θηρος, θεριον) meaning beast or wild animal. On the other hand, it may be related to the Latin *belua* (beast, animal). Irrespective of the path of linguistic evolution, this evidence from Latin and Greek confirms a relation between pile textiles and animal skins, supporting my contention that pile textiles were conceptually and functionally an ancient form of "fake fur", possibly inspired by ancient or rural habits of using and wearing animal skins (eg. sheepskin or fur).

¹⁰ The dictionaries and glossaries consulted were: Du Cange's Medieval Latin (1887) and Greek (1688/1958) dictionaries and Photius I's *Lexicon* (1965), Liddell & Scott (1940); Chantraine (1968); *The Pocket Oxford Classical Greek Dictionary* (2002); *The Pocket Oxford Greek Dictionary* (2000); and *The Collins Latin Dictionary Plus Grammar* (1997). Confirmation for Giaccherio's (1974) Italian translation of relevant passages of Diocletian's Edict of Prices came from Il Ragazzini & Biagi's *Concise Italian Dictionary*, (1993).

Most of the above terminology describes pile textured surfaces generically. It does not clearly distinguish (to us) napped cloths created by brushing up or felting wool from those textiles in which special pile threads are added or drawn out from a base cloth. The latter may refer indiscriminately to embroidered, knotted, weft-looped or warp velvet techniques, and so do not directly confirm the existence of warp velvet weaving in the Eastern Mediterranean. This terminology is also mostly undatable in any useful way. The term *trichides* (τριχιδες) appears in the ninth century *Lexicon* of Photius I, with the apparent meaning of hairy, or something having many fine hairs (Naber 1965), and identifies Aristotle among the sources of this meaning. Photius also identifies *trichapton* (τριχαπτον) as *bambykinon*¹¹ and/or a valuable or precious *himation*, for which the fifth century Hesychius of Alexandria is cited as a source; although Liddell and Scott (1940) interpret *trichapton* as meaning plaited or woven of hair.¹² Again, such dating information is unenlightening as to the existence of velvet as such, but coincides with periods for which we have evidence from Arabic sources.

It is also tempting to consider the debated term *polymiton* (πολυμιτον) as possibly referring to silk velvet, at least initially for its literal meaning – many threads. No other textile so well fits such a description as do pile cloths with their dense thickets of threads sticking up or out. Scholarship seems to agree that *polymiton* was valuable and desirable, and the sheer quantity of fine material involved would certainly heighten the intrinsic value of even plain and technically simpler velvets, and elevate them to the class of luxury textiles suitable for church and aristocracy. In a discussion of products made from sheep's wool, Pliny the Elder (first century) states that the city of Alexandria introduced *polymita* textiles (Pliny, *Naturalis Historia*, VIII, lxxiv), well before the period proposed for the drawloom and weft-faced compound structures. However, Pliny also reports that "weaving a broad-striped tunic after the manner of a frieze [long-napped] cloak is coming in for the first time now" and describes body-belts that are "villosa" (VIII, lxxiii). He reveals the existence of what seem to be brushed napped, or possibly weft-looped, woollens (*gausapae* and *amphimallia*) and another apparently constructed pile fabric which he does not link with *polymiton*. Scholars have variously interpreted *polymiton* as damask or weft-faced compound weaves such as samite. However, if we follow a naming logic based on the number of threads in the basic structural weave unit, the term *hexamiton* (εξαμιτον) seems adequate to account for the coloured figured compound twill weave, which has six threads in its basic weave unit, especially the weft sequence.¹³ The common name *samite*, (or *samitum*) for the weft-faced compound twill structure reflects this relationship to the basic weave unit, weakens interpretations of *polymiton* as samite, especially given the appearance of *polymiton* in Pliny. The patterning of compound fabrics typically contrasted only two or three pattern threads, which hardly qualifies as many threads (*poly miton*) from the weavers' point of view. By the same logic, *trimiton* may refer to a 1/2 twill with a basic weave unit of 3 threads. Interpreting *polymiton* as damask, which opposes the weft-faced and warp-faced effects of twill or satin structures without additional pattern wefts, still fit this logic, as the basic weave unit is expanded into a system of alternating groups of two opposing basic units from which many patterns can be built up. So, although *polymiton* might be thought a good name for velvet, it may be unlikely, especially if we accept a structure-determined naming logic. The extant warp linen velvets require only a repeated four, five, or six-thread basic weave unit. This level of technical discussion adds new

¹¹ Bambykinon may be a cotton material, but Nicole (1895), the French translator of the Book of the Eparch, believed that Bambyce was a type of linen, deriving from a city in Syria. (Leo VI, 1970 polyglot edition).

¹² Fabrics woven of hair were known for this period (Wilson 1933, 46-48).

¹³ The basic weave unit is the minimum repeated structural unit of the cloth, counted across the sequence of warp and weft threads. The naming logic I am following is based on the unit warp thread sequence which determines how the weaver will set up the loom. According to Flanagan (1935) and El-Homossani, C. F. Lamm follows this logic.

possibilities to the terminology debates, but resolves little. However, Pliny's early use of the term should not be overlooked.¹⁴

Other primary sources in Greek and Latin offer little indication of velvet or pile textures or techniques. The Price Edict of Diocletian (301) provides the most direct evidence of linen pile textiles. The long section on linen textiles lists three qualities of "*Manti{u}lium <v>illosorum [billosorum] Gallicorum sive mapparum*" (Giacchero 1974, § 26, lines 265-267), with the corresponding lines in the less complete Greek itemized as "[-----Γ]αλλικων [ητοι ?μαλλων] τροτιστω[---]". Giacchero translates this as napkins with pile of the Gallic type.¹⁵ Although the maximum prices are missing for these entries so that we cannot assess how special they may have been, they are grouped in sequence with a variety of other smaller household or utilitarian linen items. The best quality is priced by the loom length (Lat. *tela*/Gr. *istos*) and the two lesser qualities are priced in groups of 4. Here *pelosi* must refer specifically to linen pile constructed of fine threads. Linen does not brush up like wool, and is well-suited to towel or table use for wiping hands. This indicates clearly that linen pile fabrics were known and circulating in Diocletian's period, and apparently commonly available in the eastern part of the Empire. However, it does not clarify whether this Gallic type was a warp pile or other type, and may encompass a variety of structural types, even mixed fibre types. The link to Gaul is intriguing, but unenlightening.

Other primary sources are even less forthcoming. I have already alluded to the indeterminacy of terms with numerical components, suggesting that there are other possible numerical interpretations connected to weaving practice than scholars such as Muthesius (1997), and Haldon whom she addresses, have proposed. I found no indication of pile textiles in Constantine VII Porphyrogenitus' *Book of Ceremonies* (Vogt 1935), or in the early law codes of Justinian and Leo VI that restrict or regulate textiles. *To Eparchikon Biblion* (1970) from the late ninth century concentrates most of its attention on general guilds at an apparently entrepreneurial rather artisanal level, and is more concerned with general ethical and administrative aspects of the whole industry than with technical matters. Its descriptions of textiles restricted to Imperial use speak mainly of colours of murex purple dyes, rather than of textures. If fine silk pile fabrics had by this time emerged as the Arabic sources suggest, its regulation would have been sufficiently encompassed by regulations dealing with silks in general, as with other silks. Pure silks and any textiles woven with gold were also generally restricted to Imperial use and manufacture from the time of Theodosius, and again in the Code of Justinian (Scott 1973/1932). However, the provision seems to permit silks mixed with other fibres to be made and worn by the public, permitting silk pile fabrics woven with linen or wool wefts to have evolved as luxurious versions of the linen pile textiles. Unfortunately the textile terms possibly indicative of velvet textures or structures do not seem to appear in these documents.¹⁶ The matter merits more detailed clarification by a linguist.

So this preliminary survey shows that, for the most part, Byzantine textile literature is silent on the possibility of velvet-weaving, in linen or silk, let alone its technical and aesthetic implications. It is in the Arabic scholarship and sources, especially Serjeant's (1972) sourcebook of evidence for early and medieval Islamic textiles and the *Kitab al-Hadaya wa al-Tuhaf/Book of Gifts and Rarities* (Qaddumi, 1996), that velvet seems to be evident, and related to Byzantium – possibly revealing continuity with the early linen warp velvet finds from Egypt. This evidence requires us to investigate the presence of velvets in a Byzantine textile context, between the eighth and eleventh centuries.

¹⁴ This assumes that it is indeed Pliny's term, and not an interpretation of a later transcriber.

¹⁵ Giacchero's Italian translation (1974) reads "Tovaglioli pelosi di tipo Gallico o asciugamani personali"

¹⁶ I have used primarily Freshfield's English translation (1938) of the Book of the Eparch (1970) and Scott's (1932/1973) English translation of the Justinian Code and Novellas, and of Leo VI's New Ordinances.

Before discussing the Arabic sources, a brief discussion of Arabic terminology for velvet or pile fabrics is necessary. Two terms are typically translated as velvet, velvety, or velvet-like, and ambiguity persists among references to warp velvet structure, weft pile structures (such as corduroy or weft-looping), and the visual and tactile appearance of velvet. This ambiguity is problematic in interpreting both English and Arabic, and may never be resolved for many specific quotations. The Arabic terms most often equated in textiles study to velvet are *qatifah* (var. *katif*, *katifa*; pl. *qutuf*, *kutuf*) and *mukhammal* (var. *mukhammallah*, *mukhmal*, etc.) (Qaddumi 1996; Serjeant 1972; Goitein 1967-83). The term *khamal* (var. *khamil*, *khmal*) refers to pile but may also indicate cloth with pile or velvet (Qaddumi 1996). Goitein translates it as "velvet-like", and states that the plural term *khawamil* was "said of robes" (Goitein 1983, 411, n.239). *Mukhammal* refers to a cloth with pile or velvet (Qaddumi 1996); Wulff records the term for velvet cloth as *mahmal* (1966). From their contexts of use, these terms refer to clothing or furnishing type fabrics or garments; quite different terms (eg. *tanafis*, pl. *tinfisah*) are used for pile rugs. Following Lane's *Lexicon*, Qaddumi explains *qatifah/qutuf* as either "an inner garment with a long pile; or an outer garment [or cloak], probably of velvet" (Qaddumi 1996, 289). These terms are the main ones to look for in Arabic source material. Again, however, we can see that they do not necessarily indicate the presence of warp velvet cloth precisely, except in Wulff (1966).¹⁷

Serjeant's (1972) *Islamic Textiles* contains several quotations that refer to textiles with pile, which are translated as velvet or described as having a velvet-like or pile surface. These citations appear to refer to periods from the mid-eighth century to around 1073 AD, which is a considerable period before the earliest Italian reference to velvet in a Florentine document of 1187 AD (Reininger 1939, 958). Abu 'l Kasim reports "the velvets of the Sawad (*kutuf Sawadiya*) [Iraqi velvets] as a typical furnishing of the houses of Isfahan" (Serjeant 33, 84) and elsewhere says "Nor do I see your [Isfahanis'] houses with their public rooms furnished with ... Rumi (Byzantine) velvets (*katifa*)" (212). He thus appears to locate velvet manufacture in both Byzantium and Iraq around the mid-ninth century or later, although it is not clear if this is a warp velvet or of what material it is made. However, the description is consistent with later uses of velvet furnishings in the same region. The *Kitab al-Hadaya wa al-Tuhaf* implies the existence of Byzantine velvets as part of a diplomatic gift sent to the Abbasid caliph al-Radi from the Byzantine emperor Romanos I Lecapenus, and his co-emperors Constantine and Stephanos in 938. In Qaddumi's translation of the extensive list of precious objects included in this gift (or tribute?) we find:

"As for the wraps (*luhuf*), two are of velvet (*mukhammallah*) with a design on a violet ground (*'ardu*hu) [representing] an eagle [set] in a roundel and two horses (*farasan*) at their top; two more wraps with a similar design (*naqsh*) but without velvet pile (*bi-ghayr khamal*) ... Also ten large velvet cloaks (*qutuf*) – one of emerald green *siqlatun* cloth with elephants within its stripes (*raqimihi*); the other has within its borders (*a'lam*) rosettes (*wardat*) in the center of which there are ducks and other birds, another is also of *siqlatun* with birds on its borders, another is also of *siqlatun* but with unicorns (*wahsh dhu qarn wahid*) on its borders, [each of] the borders of another are decorated (*manqush*) with a lion in yellow, another has lion heads with wide-open mouths along the borders and a tree in the center, another of *siqlatun* that has inside its borders figures (*tamathil*) of riding kings and a unicorn and inside its roundels a winged quadruped." (Qaddumi 1996, ¶73, 101)

Describing the velvet cloaks as being of *siqlatun* cloth reinforces the idea of a Byzantine manufacture of these items. Qaddumi says that, although also produced in Tabriz, Baghdad, Isfahan and Antioch, *siqlatun* most commonly referred "particularly to a cloth of scarlet made in Siqlatun, a city in

¹⁷ I cannot pursue Arabic roots and correspondences any further, but the matter deserves further examination.

the Byzantine Empire" (280, ¶63 n.2). Other descriptions of *siqlatun* (Serjeant 1972; Lombard 1978) give no hint of a velvet surface, and as the list shows, it was not always red. The simplest interpretation of the seeming contradictions in this passage is that these items may have been lined with plain velvet, similar to an ermine-lined *siqlatun* cloak described for the Buwayhid ruler 'Adud al-Dawlah at about the same time (Serjeant 1972, 24). A warm soft velvet lining would be appropriate for aristocratic cloaks, and the use of pile for warmth on the underside of fabrics is reported for both linen and woollen garments (Kendrick 1920-22) and the patterned covers (nos. 109 & 110) in Trilling's catalogue (1982). Furthermore, such combinations might be more likely for velvets made of light silk, as was *siglatun*, rather than linen. A more elaborate interpretation of this passage would be that the velvets were figured drawloom velvets, but this does not account for the use of the term *siglatun*, unless it refers to the place or style of manufacture, or to some technical relationship to *siqlatun*. Another possibility is that these are weft pile fabrics, rather than warp pile velvets. The final possibility is that the figured designs were applied by non-woven methods – dyeing, embroidery, or appliqué.

One possible contra-indication of velvet manufacture in tenth century Byzantium is found in this passage from the *Lata'if al-Ma'arif* (ca. 961):

"The land of India is the country which possesses most rare products which are found there alone. ... [including] velvet garments (*thiyab mukhmala*) ... Thus it possesses more special products than Rum which is only reckoned to have brocade (*dibadj*) ... and *sundus*-brocade which is called *byzyun*, and various different kinds of garments." (Serjeant 1972, 217).

The mention of Rum is ambiguous here as it may refer to other European states instead of Byzantium itself, although the latter is more likely when taken in conjunction with other references to velvets in Byzantium.

The tenth century author Mas'udi, asserts that velvets (*kutuf*) were made during the reign of Hisham (724-743 AD) although he does not say where (14); this quotation occurs in a discussion of the Islamic tiraz factory system, and Serjeant seems to be implying that the velvets mentioned were a product of state rather than private (commercial) workshops (Serjeant 1972, 14). Again it is unclear what materials or technical structures were meant. Also, Mas'udi is writing long after Hisham's time, so his accuracy is suspect.

Serjeant also reports a description by Abu 'l Kasim of a textile named for the Caliph al- Mutawakkil (847-861 AD), which corresponds closely to the extant linen Coptic warp velvets, and is associated with the renowned Egyptian linen centre, Dabiqi:

"... [a] towel of light Mutawakkili Dabiki, embroidered with a tiraz border, with a velvet-like pile (*mukhmal*), made in Egypt, with two badges (? *'alam*), and two bands (*zunnar*) and their patterns of fine thread, of perfect length, exquisite width, with a short pile, bordered with a fringed (?) border (*hashiya mashkuka*), softer than kazz-silk and finer than floss-silk (*khazz*)." (Serjeant 19)

This quotation follows a discussion wherein Mutawakkili is described as *mulham*, a garment textile made with a silk warp and weft of some other material, which was favoured by this caliph and quickly became very popular. So we cannot be clear what material is meant. However, the qualifier Dabiqi, suggests the possibility of a linen or a combination of silk and linen, as Dabiqi was a renowned linen centre in the Nile delta (Serjeant 1972). If this evidence could be taken at face value, this Mutawakkili towel may conceivably have referred to an early mixed-fibre velvet. The description of a short pile, fine and soft is as consistent with linen as with silk. After washing, linen velvet is surprisingly soft and

supple. Looms for weaving half-silk textiles in the price edict of Diocletian show that such mixed textiles were common from at least 300 AD (Giacchero 1974, §12).

Other references to velvets refer primarily to Iraqi manufacture. There is also a reference to cotton velvet for India (Serjeant 1972, 217) which may be a weft-float velvet like corduroy (or possibly fustian¹⁸). According to Dhamija (1989), "fine velvet cloths, al-khamliyat" are reported of the kingdom of Rahma in the ninth century, which seems to have been a kingdom in Bengal or Gujarat (53). The merits of such reports require more in-depth scrutiny than can be given here, but they coincide in terminology and timeframe with other of the Arabic evidence. Unfortunately they too are ambiguous.

Wulff (1966) surveys an extensive variety of traditional Persian/Iranian crafts, focussing on the making processes and equipment. He provides invaluable detail about the looms and processes of traditional weaving, including velvet-weaving, which is of particular interest because it illustrates two separated long warps with independent tensioning by gravity warp-weighting for both velvet-weaving and drawloom weft-faced compound weaving (Fig. 7). He documents a horizontal rug loom set-up that is identical in all other respects to the vertical 2-beam tapestry loom, and also uses the fixed heddle and mobile shed bar arrangement required by de Jonghe and Tavernier's (1983) description of Coptic tapestry weaving. Although Wulff primarily documents twentieth century practices, these are compatible in most respects with the technological expectations of the Late Roman and early Byzantine textile production, as well as much earlier depictions of Egyptian weaving. Their simple technologies are arguably survivals of the earlier technologies although they cannot be dated. Wulff also provides an invaluable, extensive Arabic craft vocabulary, as well as information about other crafts which supplement weaving, such as carpentry (for loom equipment and combs), gold wire drawing (for threads and velvet rods), and scissor and cutlery making (for cutting pile). Dozy (1843) provides an extensive dictionary of Arabic garments based partially on medieval Arabic sources, some of which refer to velvet or pile cloth. Unfortunately, it is difficult to use for those who do not read or speak Arabic, and offers little of use to an in-depth study of early velvets.

The Material Evidence

As already noted, we have concrete material evidence for the velvet weaving technique between the fourth and seventh centuries. Several textile fragments from the burial excavations of Egypt have a warp velvet structure, executed in fine single ply linen on a foundation of plain weave linen (Figs. 8-10). I have seen 7 examples and know of 3 other reliably confirmed examples;¹⁹ my documentation of these is as yet incomplete but the requisite structural features of the examples I have seen is clear. The pile is clearly not inserted weft technique, as it lies parallel to the selvages present on some of the samples and to the warp direction of inset tapestry motifs. Two, possibly three, distinct structural variations have been noted with two distinct pile effects: short uncut loops and longer cut pile. The pile creates an overall unpatterned texture for the ground cloth surrounding the tapestry-woven motifs, which were the principle elements conserved.

The existence of these fragments implies an orderly technical setup of two co-mingled warps each with its own separate tension system. In rising perpendicularly over a rod or heavy cord above the ground cloth during weaving, the pile threads take up their length at a considerably faster rate than the ground cloth threads. This implies a method of storing the pile warp that is separate from the basic loom

¹⁸ Fustian may have been a pile fabric, like corduroy or velvet; each required special knives to cut the pile.

¹⁹ Milton Sonday (2000) is responsible for bringing two such examples in American collections to my attention. Gabriel Vial (1984), former technical specialist for the Centre Internationale d'Études des Textiles Anciens identified those in Lyon. I am additionally indebted to both these scholars for personally discussing these textiles and sharing their analysis notes with me.

frame or cloth warp beam. The pile threads require a tension that is slacker than that of the ground weave, but sufficiently taut to resist entangling that would slow the weaving process beyond reason, or compromise quality. The final requirement is an efficient method of cutting the loops evenly. Some of the examples are evenly cut, either as weaving progresses or when the piece is removed from the loom. Several of the fragments have inset tapestry motifs woven on the ground warp. The inset tapestry of MHTL 24400/118 is round, with pile all around it, the most challenging and telling situation.

Clearly the question is whether and how such weaving might have been accomplished with the kind of loom technology and weaving expertise understood to be available for the period. These fragments have thus far been dated between the fourth and seventh centuries. Those with inset tapestry motifs currently have the earliest date attributions; the later examples have tapestry motifs sewn onto the base cloth. The early examples with inset tapestry motifs imply an elementary loom and tensioning set-ups and shedding mechanisms, which is compatible with their established tapestry technique. The latter examples suggest that plain velvet cloths were being produced, which would permit faster cloth production as inset tapestry slows the production considerably and may require different specialist weavers. This change seems to reflect shifts in the economics of cloth production and divisions of labour, possibly due to higher demands requiring greater quantities. However, as these textiles are so rare among the survivals, such a shift is more likely due to other factors than demand, and it is too small a group from which to draw such economic conclusions.

I will begin by discussing key technical aspects of weaving these textiles, derived from the examples and structural analyses I have briefly examined and proposing how the above requirements may have been resolved within a context of simple technology that is appropriate to the early Byzantine period. My practical experiments and personal weaving experience will augment the documentation of other technical specialists, especially Bellinger, Sondag, Vial and de Jonghe. Finally, I will briefly discuss a single silk velvet fragment from the binding of the Bible of Theodolf, once Bishop of Orléans (France), which supposedly dates from around 800 AD (Hebbe 1879).

For textile classification, the weave structure or interlacement is a key distinguishing feature of a textile, independent and more essential than any specific proportion of threads or choice of material, or after-treatment. For the weaver, the desired weave structure determines how the loom must be set up – what spacing her threads should have on the loom, how she must order her threads in the shed (lifting) mechanism, how fast the threads will be taken up by the over and under interlacement of each thread, and consequently how the tension across the warp may shift in the course of the weaving. In velvet, the pile warp threads work differently than the warp threads of the foundation cloth in which they are caught; their length is consumed more rapidly by the height of the pile loops. So the warp of pile threads must be an appropriate amount longer than the foundation – on average from 4-7 times longer – so that it will not run out before the woven piece is completed. Alternately the weaver must be able to easily tie on additional length when the time comes, although this option is more time-consuming and may compromise the smoothness and quality of the final work. She must know in what pattern to evenly intersperse the pile warp threads alongside the basic warp threads of the shorter foundation warp. These factors are determined by the basic weave unit.

The basic weave unit identifies each warp thread's path over and under the set of perpendicular weft threads. This determines how many distinctive paths will be followed by warp threads and in what order across the width. It also determines how many distinct sheds (sequences of raised and lowered warp threads) must be created by the shed mechanism, and the order in which each shed will be lifted to insert the weft threads. This information allows the weaver to determine the order in which the warp threads should be mounted on the loom and in the shed mechanism. Preliminary investigation reveals three

distinct basic weave structures in the linen velvet examples that I or other textile specialists have documented (see Figs.11, 12, & 13). Although all three require only 3 different shafts or lifting rod arrangements and have a plain weave foundation cloth, they are distinguished by basic warp thread unit sequences of 4, 5, and 6 warp threads (of both pile and main cloth). This makes it possible to weave them with the very simple shed mechanism, suggested by de Jonghe & Tavernier (1983), consisting of:

- a) one fixed heddle rod (C1-H) which raises the first set of alternating cloth warp threads, for insertion of a weft thread,
- b) one sliding shed rod (C2-S) which raises the alternate set of cloth warp threads along with the pile warp threads, for insertion of a weft thread,
- c) another sliding shed rod (P-S) mounted above the sliding shed rod (C2-S) which lifts only the pile warp threads for insertion of a pile holding rod.

This shed mechanism is illustrated on horizontal and vertical loom set-up in Figs. 14 & 15.

All the variations seen were characterized by the following basic shed lifting sequence: C1-H; P-S; C1-H; C2-S (Figs. 11, 12, & 13). The following list below outlines the pieces I have thus far located and their weave structures when available.

<u>Collection & Inv. No.</u>	<u>Basic velvet weave structure type</u>
MHTL 24400/118	Type 5w (from analysis by Vial in MHTL files)
Vial	Type 5w (a piece from MHTL 24400/118; analysis by Vial)
V&A 1307-1888	Type 5w (preliminary analysis by Landry)
TMW 71.135	Type 5w/pp (preliminary analysis by Landry from Bellinger 1955, Fig.25)
V&A 691-1886	possibly Type 5w
RISD 16.335	Type 6w (from analysis notes by Sonday)
V&A 1351-1888	Type 6w, or possibly type 4w/pp (preliminary analysis by Landry)
V&A 717-1886	Type 4w (preliminary analysis by Landry)
V&A 682-1886	possibly Type 4w (preliminary analysis by Landry)
V&A 708-1886	undetermined

MHTL – Musée Historique des Tissus, Lyon, France
Vial – M. Gabriel Vial, Lyon, France (personal collection)
V& A – Victoria and Albert Museum, London, England
TMW – The Textile Museum, Washington, DC, USA
RISD – The Rhode Island School of Design

As Bellinger notes, some linen velvets such as TMW 71.135 (Bellinger 1955, fig. 25) have double pile warp threads in place of single ones. However, as this variation is structurally little different than using a single fatter thread, it should not be regarded as a different structural type. In the above list, this doubled pile feature is indicated by the addition of "/pp" to the weave type.

The same structural results may have been created by means of a minimal early drawloom mechanism similar to that described by El-Homossani (1985, Fig. 12), basically using unfixed heddle rods (C1-H, C2-H, & P-H) to make the three sheds instead of the above combination of fixed heddle and sliding shed rods. In any case, the pile thread usually lifts with the second cloth shed (C2-S or C2-H) in order to be interwoven into the cloth weave rather than merely poking through it. This means that the pile shed can be considered a subset of C2, and may have originated as such. Certainly, it is easy to pick up onto P-S from C2-S or a raised C2-H. Nevertheless, it is important not to confuse the warp comprising the foundation threads of C1 and C2 with the pile warp, because of their different lengths, different rates of take-up, and different tensions. This arrangement also permits the pile warps to be separated and left inactive behind the active cloth warps while the tapestry is worked.

The requirement for a longer pile warp that is rapidly consumed in frequent loops means that the warp must be either warp-weighted at the back (Fig. 14) or overhead (Fig. 16) or held on a second rotary warp storage beam (Fig. 6). A weighted pile warp set-up can even be slung over the top of a tapestry-style vertical loom with fixed warp length for the base cloth (Fig. 15). However, many scholars suggest that horizontal looms were in use from at least the mid-third century forward (eg. Bellinger, 1951; Wild 1987; de Jonghe in Lafontaine-Dosogne 1988; El-Homossani 1985), and were used for the earliest drawloom-type weaves and the weft-faced compound weaves. This argument is reinforced by the fact that the binding warp threads of weft-faced compound weaves travel over and under the wefts more than do the warp threads of the main cloth (see cross-sectional views of Fig. 2d & e), and so the former threads are consumed or taken-up faster than the latter. Differential warp take-up is accommodated automatically and unproblematically in properly segregated warp-weighted systems. Traditional Syrian and Palestinian looms (Wulff 1966, 202, figs. 284 & 287; Brody 1979) and Egyptian looms of Akhmîm (El-Homossani 1985, Fig. 12) show a horizontal warp-weighted set-up with two visibly separate warps that meets these requirements, which is conceivably a survival of very early horizontal looms like ancient Egyptian types. The length of each warp is not dependent on the size of the loom's framework (as it is with vertical 2-beam tapestry looms) because the warp can be balled up compactly or stretched out to adapt to the space available in the work area.

This Eastern warp-weighted arrangement is the opposite of that of the Greek and European traditions, which is described as being woven up, and whose warp length hangs to the weaver's feet (see Fig 5a). This is an awkward way to weave. Furthermore, while this Greek vertical loom set-up seems to work for weaving with wool warp threads, which cling onto the weft naturally, the fine, smooth linen warps of the linen velvets would tend to slip, rather than hold, especially under the added weight of pile rods. Working against gravity, it would be difficult to ensure adequately firm beating of the weft to ensure that pile loops did not pull out. Bellinger (1951) indicates that the Syrian linen weavers of Dura-Europos (destroyed in 256 AD) had long been using horizontal looms before taking up the horizontal loom for wool-weaving, possibly implying that only wool-weaving had previously been done on Greek-European style vertical warp-weighted looms. The use of linen warps thus suggests that the Greek-European vertical warp-weighted loom was not used for weaving linen velvet and that a horizontal loom arrangement is most likely. Furthermore, the horizontal loom only requires a minimal permanent frame (Wulff 1966, fig. 287) as the warp length can be suspended from the wall or ceiling at any convenient angle, even over the weaver's head (Brody 1979, figs. 6-11 & 12); Roth (1913/1978, fig. 34), although more elaborate permanent loom frames developed to hold the increasing complex and permanent shed mechanisms.

It may also be significant that the Egyptian warp-weighted loom illustrated by El-Homossani (1985, Fig. 10) is from Akhmîm. Akhmîm is the site where all the V&A velvet examples were found. Akhmîm was an important linen weaving centre from Roman times (Bagnall 1993), and very early weft-faced compound textiles have been found there (El-Homossani 1985, 233), and in other cities in Upper Egypt. It seems likely that a renowned weaving centre would be as able to invent such textiles, or to quickly learn to duplicate it if it had been imported initially, from Syria for example. The rarity of our velvet examples can be taken to indicate that the velvets were imported to Egypt, as Bellinger concludes (1955). However, as so many are distinctly associated with Akhmîm, so far as I have yet determined, we may also be looking at evidence of a local fashion or specialty. As the finds are various dated between the fourth and seventh centuries, it is difficult to argue that they are the specialty of a specific workshop, although some localized mode of continuity or industrial secrecy may be indicated.

Whether Egyptian or Syrian, these linen velvets are very likely to have been known elsewhere in the Byzantine Empire. Diocletian's price edict shows that Syrian and Egyptian linens of many types were available to the Eastern Empire (Giaccherio 1974, §26). Although the only pile linen listed in the edict is identified as Gallic, the suitability of the Eastern warp-weighted linen loom to the velvet technique, the survival of the Eastern warp-weighted drawlooms into the twentieth century especially for Persian velvet-weaving (Wulff 1966, 209-210), and the undoubted competence of Egyptian and Syrian weavers with linen strongly indicate that these early linen velvets were woven on such warp-weighted horizontal looms.

The simplicity of the minimal shed mechanism requirements for weaving these velvets does not preclude more elaborated shed mechanisms. However, the pile effect is consistent in length and distribution over the surface and in the earliest linen velvets serves as a textured background to inset tapestry work, for which only very simple shed mechanisms are required. More crucially, the inset tapestry work in these early velvets is characterized by the crossed threads phenomenon at the beginning and end of the tapestry work, as discussed in depth by de Jonghe and Tavernier (1983). A key feature of their discussion is the use and manner of insertion of a second sliding *louisine* rod (L-S), ahead of the sliding shed rod C2-S, to reduce the warp density of the tapestry-woven sections so as to produce a flat-lying rather than a rippled cloth. Inserting the *louisine* rod, that automatically causes some threads to cross over each other (see Fig. 17), is more efficiently accomplished with the fixed heddle-rod and sliding shed rod mechanism than with individual heddle bars, and it can be removed and reinserted quickly and in small sections. It is a single step solution that does not affect the heddle rod, and retains the C2-S and P-S shed rods out of the way behind the *louisine* rod. The alternative approach, adding two additional heddle bars for the tapestry weave to a 3 heddle-rod velvet set-up, does not automatically create the crossed thread effect or justify its appearance. The crossed threads are evident on examples with inset tapestry sections (MHTL 24400/118 and V&A 682, 691, & 708), indicating that these pieces were likely produced using the fixed heddle-rod and sliding shed-rod mechanism. My experiments have shown that these sliding rods do not interfere with each other; the C2-S and P-S rods are moved back out of the way while the tapestry is worked and the *louisine* rod is removed when the tapestry work is finished. The *louisine* rod L-S can be inserted in only small areas for isolated motifs. The pile warp remains behind the warp during the tapestry weaving (see Fig. 17).

The pile effect is created by the loops of warp threads lifted by P-S and held up over the inserted pile rod (P-ROD), as weaving progresses (Figs. 18 & 19). This pile rod, which may be a fine, smooth, and even wire, stick, reed, or heavy cord, is later pulled out of the weaving to leave loops (Fig. 18), or cut out to leave tufts of cut pile (Fig. 20). Once they are well-secured into several inches of woven cloth, the loops may be cut safely. Loops that are too short or too loosely packed may pull out of the weaving too easily. However, the pile rod must remain in place until enough rows of weaving have been executed to secure it firmly in place; otherwise the tension on the pile threads will cause the loops to pull out when the pile rod is removed. If cutting is done while the pile threads are under tension on the loom before there is enough subsequent weaving to secure the pile, the pile warp threads will pull right out of the shed mechanism and, if warp-weighted, will drop right off the loom. My experiments with fine knitting needles show that relatively short linen loops can be safely cut. However, the ancient linen cut piles are all relatively long, about .5 cm. This suggests that the scale of the available knives of sufficient sharpness was a factor in determining what length of loops would be cut, and possibly a factor in the rarity of this technique.

The very short loops seen in V&A 1351 produce an even but relatively sparse texture that allows the foundation cloth to show. The longer loops, whether cut or uncut, produce a denser pile surface that

effectively conceals the cloth beneath, especially if the piles are doubled (as for TMW 71.135), or made in weave type 6w. The pile ends of V&A 682, 691, 708, 717, and 1307 are about .5mm long, and all appear to have been cut. Although it is possible that the loops broke as a result of the brittle linen remaining bent for centuries, one would expect that some loops might have survived intact, as in the weft-looped pieces, and I saw no evidence of unbroken loops in my preliminary inspection. Furthermore, the short loops of V&A 1351 remained unbroken. Vial was of the opinion that MHTL 24400/118 and his own fragment of it were cut (Vial, 1964).

So we must consider the cutting process and possible cutting implements which will produce an evenly cut pile surface. However, the method of cutting is interdependent with the type of pile rod (PR) used, so they should be considered together. A round pile rod (short pile) or a flat rectangular pile rod (for longer pile) is adequate for holding pile that is not to be cut, if the rod is smooth and of even shape so that it may be pulled out easily without not pulling on the pile loops (Fig. 18). Freehand shearing of the pile surface *en masse*, once all the pile rods have been removed is unlikely to produce an even surface especially for longer loops. Longer loops often twist back on themselves, making it difficult to slip a blade into the loops, capture them all, and make an even cut once the rods have been removed. Flat knife blades must be very sharp to quickly cut through the loops for the best result. However, the abrasion of the many linen threads dulls blades rapidly so that the workshop or the weaver needs a ready supply of several blades and likely a whetstone for frequent sharpening.²⁰ The action of shears pulls less on the threads but if inserted into the loop, they may not cut right at the top of each loop. If not inserted, the loops would have to be longer than the length desired, because the top of the loop would be cut off.

Two simple methods within the capacity of the Byzantine technology (assuming sharp blades are available) come close to the efficiency of latter velvet cutting systems. The first method is easiest with a round rod (although it will work with a rectangular rod) and a blade that tapers to a point. As shown in Fig. 20 (top), the blade is inserted from one side, cutting side held steadily up, as the rod is withdrawn out the other side; the blade can even help push the rod out as the worker slides the rod and blade simultaneously through the loops. This works well with blades that are wider than the loop length, because as the loop slides up the slope of the sharp edge, it will cut itself. For the other cutting method, two thin flat rectangular bars are inserted as one pile rod, perpendicular to the plane of the cloth, as in Figs. 19 and 20 (bottom). A sharp blade is inserted between the two bars, cutting edge down, and drawn along the groove between them with just enough pressure to cut the loops. Once the loops are cut, the two bars fall out. Either of these methods has the potential to have inspired development of the later grooved rod and blade holder system, which improves the safety of cutting. I can imagine two other simple methods, but suffice it to say that the linen velvet weavers had solutions available to them.

These solutions depended on the sharpness and durability of blades, which was controlled by knife-makers, or possibly sword-makers, facets of the Eastern Mediterranean cultures that I have not yet examined closely. However, there is no doubt that shears and knives existed for the period, as did larger blades for defense. The metal work skills so evident in jewellery and making metal threads of this period would have been suitable for the creation of fine metal rods or flat bars which could be used as pile holding rods as I have described.

These are the main technical issues that arise from the existence of these linen velvet fragments, which their weavers were clearly resolving, within a richer and more ingenious technology than is apparent in the majority of the more accessible textile literature. Furthermore, I think there is evidence to link features of velvet-weaving to other types of contemporaneous textiles common in the region,

²⁰ I found that only a tempered steel surgery scalpel was sufficiently sharp to cut for more than one or two passes of the blade.

although a detailed discussion of these links is beyond the scope of this paper. Nevertheless, such links between other textiles are crucial to a thorough examination of the possible transformation of the velvet technique into a silk textile.

Establishing a direct connection between the linen velvets of the early Byzantine period and the later silks is made difficult by the lack of preserved artefacts and the ambiguity of the written sources in which the pertinent terms or descriptions appear. However, it is possible that one such silk velvet fragment may have survived to show such a connection. This fragment is on the binding of the Bible of Theodulf (d. 820), first abbot of Fleury-sur-Loire and later Bishop of Orléans in France who apparently traveled to Rome around 800 AD. Hebbe (1879) reports that this fragment on the spine or back of the bible seems to be the remains of the original binding, rather than a part of subsequent rebinding occurring in 1511. He says that the verses of Theodulf, contained in the Bible, describe its binding as "*de couleur pourpre, ornée d'or et de pierre précieuses*" (2). The more detailed description of the numerous textile pieces that Theodulf stitched into the work to protect the gold and silver illumination of the manuscript includes the following descriptions of the binding textiles themselves:

"17. Cut silk plain velvet, colour purple of Tyre, with a twill foundation cloth of the primitive colour of the seventh or ninth centuries, the period of the making of the Bible. This fabric is not represented in the separate album, it is found in small [poor condition? fragile?] scraps on the actual cover.

18. Cut silk plain velvet, colour crimson, dyed with cochenille and whose foundation cloth is "gros de Tours" [a warp-faced plain weave]. It exists in large pieces on the cover and was noted in 1839 by Ph. Hebbe as being used in the restoration done in the time of Pierre Rostaing, in 1511. It thus does not appear in the separate album." (my translation of Hebbe 1989, 6-7).

This evidence needs more careful examination. However, if it can be substantiated, it would show the existence of silk velvet, with a twill foundation cloth around 800 AD. This would add to the credence of the Arabic references to velvets between ca. 724 and 1067 AD. It would also raise additional questions, of whether it was evidence of velvet manufacture in France, or a case of importation. At the moment, this evidence is an anomaly for velvet history. Medieval records of velvet in Paris in Boileau's *Livres des Métiers* (latter half of thirteenth century) are the earliest documentary evidence of velvet-weaving in France (Depping 1837). So I provisionally conclude that, if original, the Theodulf velvet was likely imported, possibly as a gift or picked up on his visit to Rome. If so, this may also have come from even further afield, from Byzantium or another Eastern Mediterranean source, as we have seen that Eastern textiles circulated widely.

The Bible of Theodulf velvet evidence also has implications for technological links with weft-faced compound twill weave structures (*samite*). This structure has a basic weave unit of six threads (Fig. 21), in which "main" warps alternate with "binding" warps in a 1/2 twill structure, similar to the interspersal of pile warps regularly through the foundation cloth warps of twill velvets.²¹ The two-harness shed mechanism controlling the warp threads is organized as two sections, H1 & H2. One harness set of 3 controls the binding warps (H1-B) and opens the shed for the binding weft, just as C1-H and C2-S do for the linen velvets. The other harness set of 3 or more controls the design sheds (H2-D) which govern the appearance of the 2 or 3 coloured pattern wefts on the face or reverse of the fabric to form the image, just as the single P-S permits the raising of only the pile threads. The main warps often occur in side-by-side pairs, just as do the velvet pile warps of TMW 71.135. Samite weaving employs a two-warp loom set-up at least to regulate accumulated tension discrepancies between the two warps as weaving

²¹ Without more detail about the Theodulf velvets, it is not possible to draw closer comparisons.

progresses because the binding warp is consumed at a slightly faster rate than the less active main warps, as occurs in velvet-weaving. It may be that the main warps of weft-faced compound weaves – which are always concealed by the pattern wefts and function primarily to lengthen and pack more densely the visible pattern floats – represent an application of the 2 harness bi-partite mode of organizing the velvet weave structure (foundation rods C + pile rod P-S) converted to a three heddle twill binding system, with a single draw heddle rod. Although the samite is used for figured patterns while the linen velvets have a plain uniform texture, we can speculate that samite's organizational principle of two sets of warp threads and two sets of shed types is an expansion of the same bi-partite principle on which the simpler velvet structure and technique was organized. In other words, the velvet technique may be a precursor to the weft-faced compound fabrics, which were originally developed in linen and wool before they were adapted to silk, quite possibly in Syria or Egypt (Bellinger 1952; El-Homossani 1985; Wulff 1966). Then, following the full development of the two-warp system of figuration in compound twills and other figured fabrics, the idea of figuration was transferred back to the velvet technology (possibly in the thirteenth century) by expanding its single pile shed to a set of sheds that lifted pile warps selectively to make figural patterns with precise control of colour or a palette of flat, looped, and cut pile textures. A velvet with a twill base, such as the Theodulf binding, may substantiate such a connection to the twill-based structure of samite. The German term for velvet, *Samt*, which derives from the Latin / Greek roots of *(e)xamitum/hexamiton*,²² may thus preserve a legitimate archaic connection with velvet, rather than being the "mistake" as has often been suggested.

The Byzantine Social Context for Velvet

Returning to the issues raised by the linen velvets, I want to consider why they were made, and possibly remained popular for a long time without leaving more evidence of their existence. The intrinsic or practical benefits of velvets are that their pile renders them both warm and cushioning. In addition, the pile can hold or shed off light moisture so that it does not penetrate through to the foundation cloth or the skin underneath. Linen is also less irritating to the skin than is wool. The arid environment of Egypt and Syria, where linen predominated, tended to be hot during the days and cool at night. Many garments are reported to have done multiple duty, serving variously as cloaks and coverings for sleeping at night, or as covers draped over mattresses that also were used for daytime seating (and décor) and nighttime sleeping (Goitein 1983, Oikonomidès 1990). A linen garment at the Metropolitan Museum of Art (no. 90.5.901) shows loops on the inside. We also have reports of napkins or towels described as having a pile surface. Bedding and the various cushions, pillows, mattresses, and towels for washing typically constituted the predominant category of goods listed in Byzantine wills of the eleventh century (Oikonomidès 1990), and were similarly prominent in the inventories of goods from Egyptian tombs of 2000 BC.²³ Warm garments, bedding and furniture covers, and cloths for washing and drying oneself must have been in steady demand throughout the intervening three millennia, just as they still are, so much so that they excited little comment from either contemporaneous authors or from textile historians.

Economically, the velvet technique confers the enormous advantage of being rapidly and uniformly woven, as the entire row of loops is created simultaneously rather than painstakingly forming each loop individually. This is minutely offset by the time and cost of making the extra-long warp, and fiddling with the warp weights to get the tensions right. Finding weavers with the requisite weaving knowledge may have been more difficult. However, since we do not know how many velvets might have been

²² See entry "Samt, älter Sammet" in Trübner, K. & Götze, A. (1955), 8-9.

²³ Several large sheets or covers were found in the tomb of Wah, estate manager of Mekutra, Thebes.

made without ornament, or perished in daily use, we cannot know if velvet-weaving was as rare as it appears today. There may have been a preference not to use it for burials, and more everyday towels and divan covers may have been plain velvets.

The tapestry motifs of V&A 717, 1307 and 1351 are all sewn onto the velvet cloth, suggesting that plain velvet cloth was manufactured. These tapestry motifs must be more closely examined to determine whether they were cut from earlier cloths into which they had been woven or woven as independent motifs, which may indicate a division of weaving labour and loom specialization which differs from other indications that garments were woven to shape in a single large piece. This could mark a shift to narrower yardages from which garments were assembled in smaller pieces, for which we have later evidence. This tendency is more closely associated with the economy of the horizontal cloth loom handling long warps, capable of producing many garments rather than one at a time, which is the capacity of the 2 fixed-beam vertical loom illustrated in Egyptian tomb depictions (Carroll 1986; Lafontaine-Dosogne 1988). The horizontal loom effects an economy of labour by distributing the time of setting up the warp on the loom over the production of several garments or items and streamlining the work to the efforts of a single weaver working continuously in the same skill, rather than orchestrating two workers or two types of skill. The tapestry work is marked slower to execute than is the velvet-weaving; when woven inset into the cloth, it slows the pace of weaving the whole cloth. Segregating these types of work to different looms and workers, perhaps to different workshops, may have improved the economic flexibility of the textile industry to meet multiple demands for a range of cloth types at a better cost. Even if we accept this argument, it should be interpreted as a gradual shift, that accepts that both methods of garment making may have co-existed, along with a range of looms.

The argument that the low cost of labour and the desirability of goods that conspicuously displayed excessive labour would tend to reduce the pressure toward more economical production becomes untenable when we look beyond the upper stratas of the court and wealthy aristocracy to consider the larger context of textiles across all strata of society. Moreover, although conspicuous display of virtuosity and preciousness implies wealth that is either infinite or continuously replenished, in practice wealth is finite and subject to disruption. We can see in the history of the Byzantine Empire that both the state and the wealthy land-owners were subject to economic pressures and had to balance these against means, purposes, and social circumstances (Threadgold 1997). Diocletian's price edict, revaluations of currency, reductions in the distribution of military or honorary clothing as elements of payment, and the monopolistic policies reflected in the provisions of the Justinian Code (esp. XI, §viii) and the *Book of the Eparch*, all show that economic elements were taken seriously. Economies of production must have been important for goods for the middle and lower strata of the population, for whom basic clothing and bedding necessities were major expenditures. Weaving economics had to support not only the artisans' dependents (including workers) but also public taxes and responsibilities for furnishing clothing to the military and as part of the salaries of state officials (Justinian Code, XII, xl; also Oikonomidès 1997). Maniatis (1999) emphasizes the existence of a range of product qualities and scales of production that is significant to workshop economics.²⁴ Legal provisions that bound artisans to their professions (JC, XI, §ix, 5) and their localities (JC, VI, §i, 5), set the prices for slaves (PN, §XXXIV, 11), relieved artisans of civic duties (JC, X, §lxiv, 1), restricted monopolies (JC, IV, §lix, 1) and regulated the structure of textile guilds and trade with foreigners (*Book of the Eparch*), also implicitly show attention to economic factors.²⁵ Although this concern is primarily directed towards

²⁴ Wills in Goitein (1983), and the range of goods and financial concerns expressed in the Letters of Medieval Jewish Traders (19_) exemplify some of this range.

²⁵ JC is the Justinian Code; PN is Basil I's *Procheiros Nomos*, published between 867 and 879 AD.

society as a whole, as opposed to the citizenry as individuals, economies of production and distribution would have assisted individuals by stabilizing the costs of goods and production capacity, just as currency stability assisted them. One of the most important points made by Threadgold (1997) in his description of Byzantine society is the underlying strength and resilience that the economy developed in the early period up (at least until the final years of Justinian's reign) in which textile production played a major role for Egypt (Bagnall 1993). This point is arguably true for other parts of the empire, judging by the enormous range of garments and textile types itemized in Diocletian's price Edict, in comparison with any other category of goods (Giacchero 1974). It is therefore crucial to acknowledge the broad scope of textiles in the Byzantine sphere of daily life if we are to understand the place of the linen velvets, even if all the available evidence about textiles and commerce elucidates only a fraction of what was produced.

We should also consider aesthetic factors present in Byzantine society as affecting the design and desirability of velvet textiles. The question of aesthetic preference cannot be dismissed; it appears in the contemporaneous descriptions of textiles and more generally in artwork, as collected by Mango (1972). Here we see that the aesthetic qualities of objects that excite commentary are colour, light (brilliance, luminescence), preciousness of materials, and types of imagery, as well as the beauty, magnificence, or amazement of the total impression on the viewer (also Grabar 1997; Trilling 1997; Qaddumi 1996). Appropriateness also becomes a subject of comment, often with religious and/or political connotations. By the time of Constantine VII Porphyrogenitus, appropriate ceremonial attire is tightly prescribed, as the *Book of Ceremonies* shows (Vogt, 1935-40, Ch. 46). This is as true of textiles descriptions as it is of other works, but we have fewer examples of textiles descriptions and, as already noted, these are often cryptic or ambiguous. Descriptions of textiles usually mention colour, especially the restricted Imperial purple, which most specifically carried socio-political status. Intensity and quantity of the authentic purple dye was also a source of regulation, but rarely distinguished in descriptions. Nevertheless, the development of silk velvets would have been consistent with an interest in intense, rich coloration, as the cut pile of velvets, like carpets, deepens the colour of the thread, and its folds possess a subtle iridescence as portions of the shiny threads' length are enable to reflect light.

The second most important feature described is the presence of gold or silver thread, inwoven or embroidered, and adornments of gold discs, pearls, and precious stones, which also carried socio-political status, as textiles woven with gold or silver, and pearls, hyacinths and were also restricted to the Imperial use (JC, XI, §viii). The development of silk velvets would also have been compatible with shiny, jewelled ornamentation, as a deeply-coloured matte background that would contrast the sparkling adornments and thus enhance their magnificence and their patterns. The sturdy body of velvets would also support the weight of precious stones, although inwoven gold threads would be obscured behind the pile surface. The element of preciousness is also encompassed by the excessive quantity of silk that is required to make the velvet pile, a conspicuous consumption of material that also applies to the earlier wool and linen pile fabrics. For those not in a position to afford or flaunt conspicuous luxury, the more modest luxury and decorative textural interest of the looped or cut linen velvets may have offered an equivalent effect. For the aristocracy, plain silk velvet would have been a conspicuously luxurious textile for more everyday or warm, non-ceremonial wear or upholstery.

The third most important feature described is imagery, especially figurative imagery. Although depictions of emperors and associates show that precious adornments were arranged in decorative, often geometric, tile-like patterns (Cormack 2000; also surviving textiles in Muthesius 1997), those that excited the most comment were figural depictions of animals, people, and vegetation. This is consistent with the types of figural motif that we see in the collections of "Coptic" Eastern Mediterranean textiles,

(typically the tapestry/plain weave types) but not with the proportion of smaller geometric-repeat designs in weft-faced compound weaves that also appears in these collections which are often contemporaneous. The weft-faced compound weaves were developed into elaborate figured textiles, especially for silks. The elaborated drawloom conferred vast figural design possibilities on a basic technical set-up with less labour intensity than tapestry, in silk, and with a more flexible drape suited to garments. Designs could be conceived like mosaics, built up of combinations of minutely scaled contrasting weave units into a larger repeat or elaborate single motif. Tapestry could also be executed on this loom if desired. The desire for figural imagery as decor was an enduring, well-established one, reflected across the arts.²⁶ I take the predominance of tapestry and weft-faced compound weaves, and the elaboration of the drawloom capabilities, to be primarily driven by this interest in naturalistic or symbolic figuration, and perhaps related to narrative impulses as well.

Interpretation of the presence of imagery in textiles must be done cautiously, however. For example, the presence of pagan imagery was not necessarily a marker of the religious identity of the owner or of a dominance of paganism in the culture, for the popularity of pagan imagery and narratives, or of the classical legacy of Graeco-Roman culture remained popular as secular motifs under Christian conditions. Mundane habits of decorative preference, or a sense of appropriate décor, were persistent, especially at the more modest levels of society or rural populations, if only because cloth and other goods were costly, and kept for a long time.

It is tempting to regard the Byzantine iconoclast debates on the use of imagery as promoting an environment conducive to emphasizing textural fabrics such as velvets, or simple patterns like twill lozenges or checkerboards that are based on the geometry of the grid of intersecting threads. However, the Christian iconoclast debates centered primarily on the representation of Christ and divine figures, sometimes extended to the representation of humans, in primarily religious contexts. So far as can be judged by the roughness of dating the surviving textiles, the periods of iconoclasm do not seem to have eliminated the use of naturalistic figuration, even of people. What can be said is that geometric patterning and decorative textures, possibly velvets, as well as colour effects, were available alternatives for those with strict iconoclast ideals.

The aesthetics of the Byzantine culture, at least as it is reflected in the contemporaneous commentators (Mango 1972) seems to be primarily visual. Textiles however are equally, if not more so, a tactile form, for which an aesthetics of touch and flexibility are important features for the user. Velvets have luxurious tactile properties to attract consumers, which include softness, warmth, durability, suppleness, and a springy body. The luxury qualities of both silk and linen chosen to make velvets include smoothness, light weight, strength, durability, suppleness, and delicacy (fine diameter of thread). All of these tactile factors influence the assessments of quality, preference, desirability, and value of textiles for their users, and help constitute the accrued meaning of specific textiles, amounting to a tactile aesthetic that may be implicit in visual characteristics, but not overtly recognized. Furthermore, if linen velvets mainly circulated as primarily practical textiles, even as clothing, or if their texture was primarily associated with middle classes or household textile uses, they may have been considered by commentators to be commonplace, not requiring comment. Typically, towels, napkins, or "covers" are rarely described beyond colour, unless they possess unusual decoration. Byzantine commentators are primarily observers at a distance; few document how their clothing or blankets feel or facilitate their movements, or comment on non-visual feel, in contrast to some Arabic sources (Serjeant 1972).

²⁶ Trilling (1997) provides an interesting discussion of the Byzantine impulses for naturalistic art and what he calls "conspicuous virtuosity" of craftsmanship.

All of these functional, economic, and aesthetic points bear on the question of why so few linen velvets have come to light, and why velvet appears to be absent from the recognized body of textiles classified and studied as Byzantine. This sometimes reflects the assumption that scarcity in the surviving artefacts and in the contemporaneous records is proportionate to scarcity in the society of the day, although that assumption is no longer as prevalent as it once was. However, another intervening factor to consider is that of historiography and the conditions which affect the scholarship of these textiles, including the classifications of "Coptic" and "Byzantine". Byzantine textile studies have concentrated on the innovations in textiles that seem to be peculiar to Byzantium; textiles previously developed are of less interest, even though a wide spectrum of simple everyday textiles was certainly available. Furthermore, few such ordinary textiles survive so long.

By far the vast majority of both the linen and silk textiles preserved through ancient and modern collection practices have been textiles bearing imagery. Textiles without imagery or decorative patterning, however structurally interesting or attractive, typically only get preserved as incidental attachments to what is really being collected – the imagery or the garment form (eg. Sondag 2000). This is the case with all the linen velvets, which have been preserved only because they surround a tapestry motif. The older catalogues of these textiles, Kendrick's catalogue (1920-22) for the Victoria and Albert Museum collection in particular, have taken much less interest in the details of these background fabrics, and thus provide cursory or vague descriptions of the velvets that obscures their presence as velvets. This effectively erases velvet-weaving from a place in a early Byzantine textile technology, and effectively erases the early Byzantine velvets from a place in the history of velvets and other textiles which may have been influenced by this velvet-making.

The absence of discussion of the silk velvet of the Bible of Theodulf from the Byzantine record, despite Hebbe's documentation (1879), is a different matter. Leaving aside the accuracy of its dating to ca. 800-820, which remains to be investigated, Muthesius has included other textile types related to this Bible in her comprehensive list of Byzantine textiles (1997, M123a-l). Muthesius describes these textiles as those which had been inserted between the illuminated pages, which Hebbe (1879) reports as being conserved in a separate album. What Muthesius, or her source Pfister, has overlooked is the Bible binding itself; unless they take the whole binding to be of later vintage, perhaps in the belief that velvet was necessarily of later vintage. Either way, the segregation of the Bible binding from the album of contemporaneous textiles may have prevented further investigation of the binding on the spine/back that Hebbe describes as original and therefore as a Byzantine velvet. Given the eminence of these and other scholars, omissions of this kind in their oft-studied work contributes to the perpetuation of an inaccurate picture of early Byzantine weaving that fails to acknowledge velvets and their special weaving technology.²⁷ This is less a criticism of their scholarship as such – for I have enormous respect and gratitude for the work Muthesius has accomplished – than an illustration of the on-going problem of segregating knowledges too strictly which can result from classifications or disciplinary boundaries.

Conclusion

In this paper I have examined evidence suggesting a Byzantine origin for velvet-weaving, taking "Byzantine" to include Egypt, Syria, and Palestine under Byzantine rule between the reign of Diocletian and the seventh century. I have begun to identify a lexicon of pile or velvet textures or textiles in Greek, Latin, and to a lesser extent in Arabic. I have found that the documentary evidence from Byzantine period sources – whether Latin, Greek or Arabic – is ambiguous primarily because of the inherent

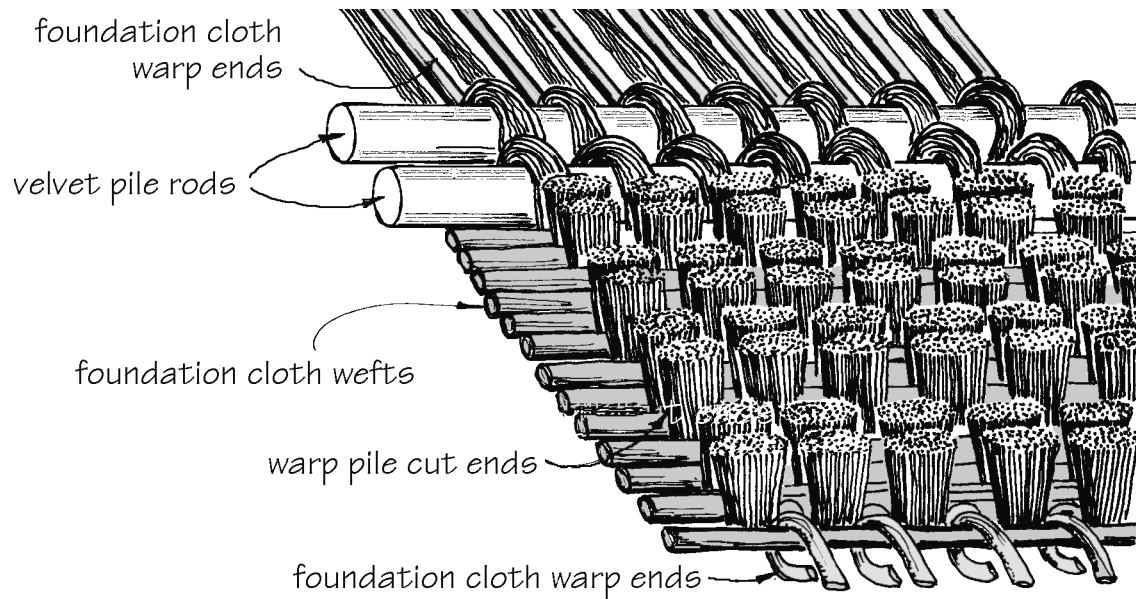
²⁷ Both Hoskins and El-Homossani are both experienced scholars of Coptic textiles with strong technical awareness of structural implications. Neither scholar was aware of these linen velvets until I drew their attention to them.

ambiguities of ancient terminology and interpretation. Terms may be intended or interpreted simply as general adjectives describing texture or any type of pile, as well as the specific velvet textile as a product of warp-pile technique. Unequivocal connections between textiles mentioned in any given historical report (and sometimes in the scholarly literature) and particular textiles cannot be easily established, if at all. So we cannot determine whether or not velvet was a textile product of Byzantium or circulating there in this early period.

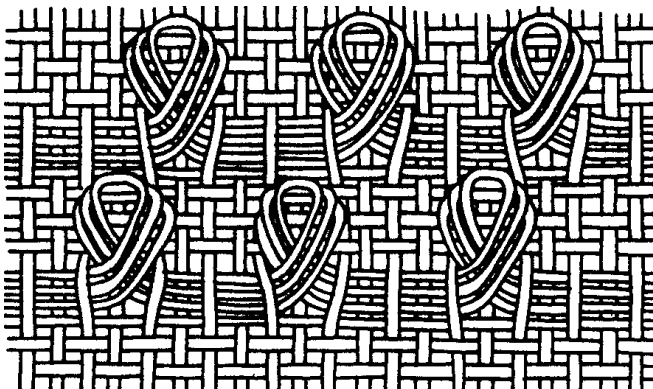
I have shown that several surviving fragments of Byzantine or "Coptic" velvets are warp-pile velvets, which carries particular technological implications which have not previously been studied in depth, even by those aware of their status as velvets. The key technical implications were revealed to be primarily related to the loom and tension set-up, rather than complexity of weave structure or skill as such, although the mode of cutting may have been new. The requisite technology for making velvet was clearly available to competent and ingenious weavers in the Byzantine empire, but may have been a workshop specialty. I have suggested significant links between the weft-face compound weaves and velvets based on technical features of the textiles and weaving practice, as well as how weavers orchestrated the design and set-up of the loom. I have surveyed practical, social, economic, and aesthetic factors favouring the continuity of velvet weaving in Byzantium and its possible emergence in silk-weaving, despite the paucity of surviving artefacts. I have outlined reasons for the obscurity of velvets in our knowledge of the textiles of this early period. I believe this has demonstrated the importance of broadly interdisciplinary research, such as Muthesius advocates, that integrates a detailed understanding of the technological knowledge involved in weaving practice and conception, beyond the limits of developing complex equipment.

Much of this work is preliminary and requires further investigation and elaboration, especially in relating velvet weaving to numerous aspects of the economic, social, political and historical conditions over time. This research remains strongly speculative in the face of much indeterminate evidence, but I believe these speculations to be warranted and the evidence to be more than circumstantial. The detailed list of elaborate textiles sent from the Byzantine emperors to the Abbasid court in 938 AD is the most compelling evidence for the existence of silk velvets in the heart of Byzantium, possibly as a special, restricted product of the Imperial workshops. An unpatterned but Imperially restricted pure silk velvet would likely have been limited in quantity and circulation and apparently less interesting than figured cloths, partially explaining its lack of survivals.

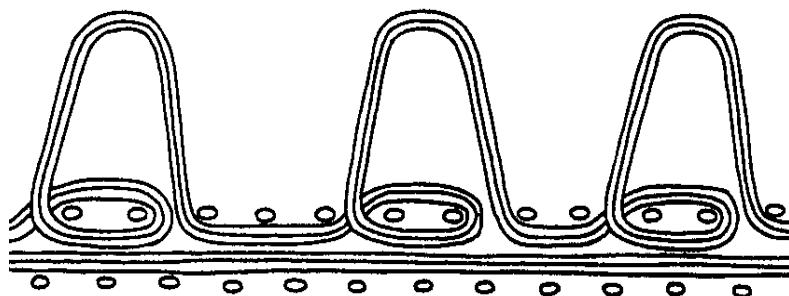
The lack of surviving artefacts and clear testimony remains a formidable obstacle to confront. I have been unable to demonstrate clear continuity between the early linen velvet and the emergence of silk velvet in the Byzantine Empire, but I have established the plausibility of continued, if limited, velvet-weaving between the sixth and twelfth centuries within the Byzantine sphere of textile culture, despite the gap in the material record. It behooves us to assemble, as Muthesius and other scholars have been doing for Byzantine silks, all the stray evidence pertinent to these ancient velvets (Appendix B) and submit it to intense scrutiny, at least to examine, if not to determine, its potential veracity. We may never be able to determine if, when, or where warp velvets were produced in Byzantium but we cannot overlook the possibility that at least some of the evidence is an actual testament to the presence of silk warp velvet there. Acknowledging this possibility expands our understanding of the ingenuity of early weaving technology and may to some extent explain particular developments evident in the surviving material. This is one phase of my larger on-going study of velvet textiles.



a. Velvet - pile formed from threads in warp direction raised over pile rod inserted into a pile shed.

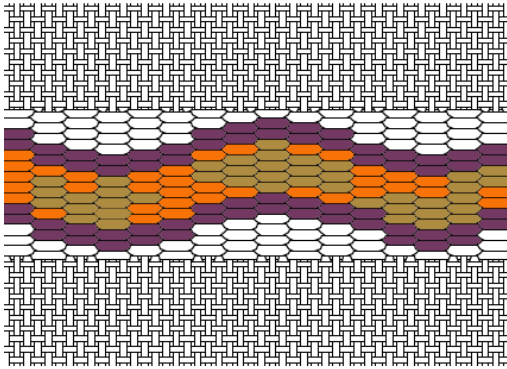


b. Weft-looping – pile formed by inserting thick wefts into a weft shed and pulling up loops with fingers, usually over rod to regulate height.



c. Weft-looping – pile formed by wrapping thick wefts around warp threads as weft is inserted.

Figure 1. Detail drawings distinguishing warp velvets (a) and weft-looped piles found in Coptic textiles. [Drawings b & c from Lafontaine-Dosogne (1988), figs. 128 & 1291.

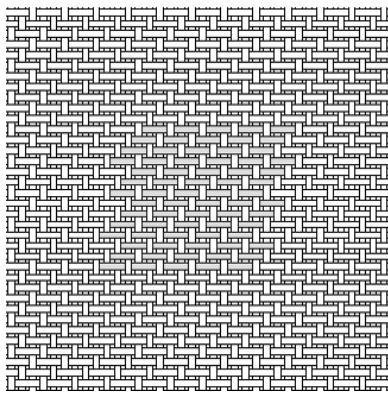


a. Tapestry motif surrounded by plain weave.

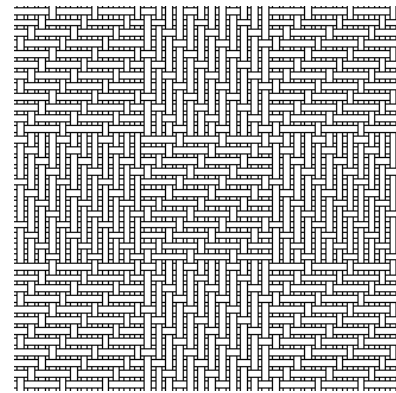
b. 1 /2 twill weave.

c. 3 /1 twill damask weave.

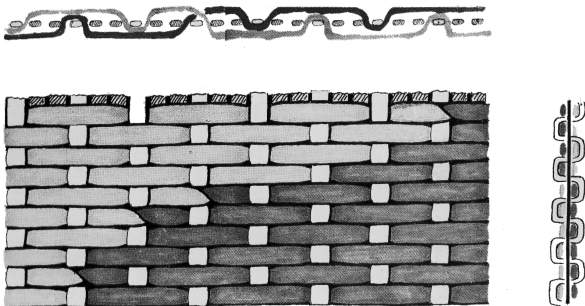
a.



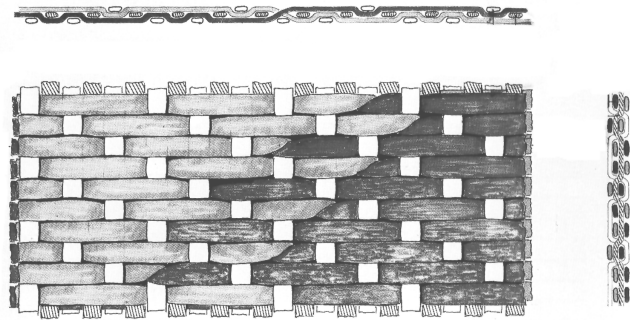
b.



c.



d. Weft-faced compound tabby (plain) weave with two main warps (warps that never show on the surface).



e. Weft-faced compound twill with one main warp; also known as samite, or *samitum*.

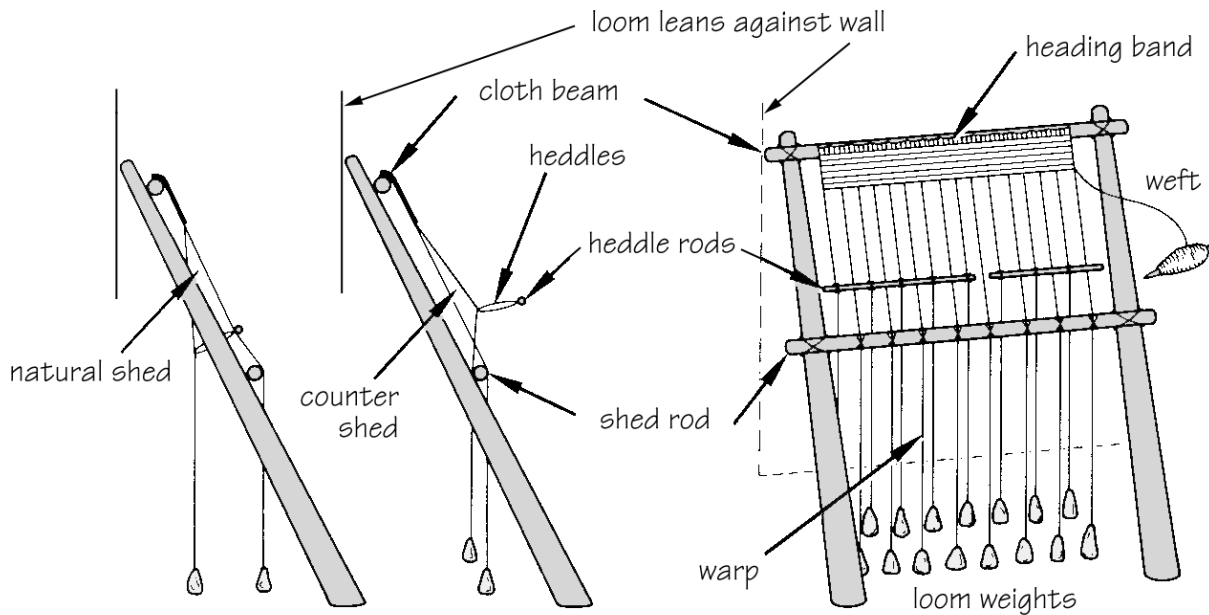
Figure 2. Some common Byzantine weaves. [Drawings d & e modified from J. Lafontaine-Dosonge (1988), *Textiles Coptes*, figs. 141 & 145.]



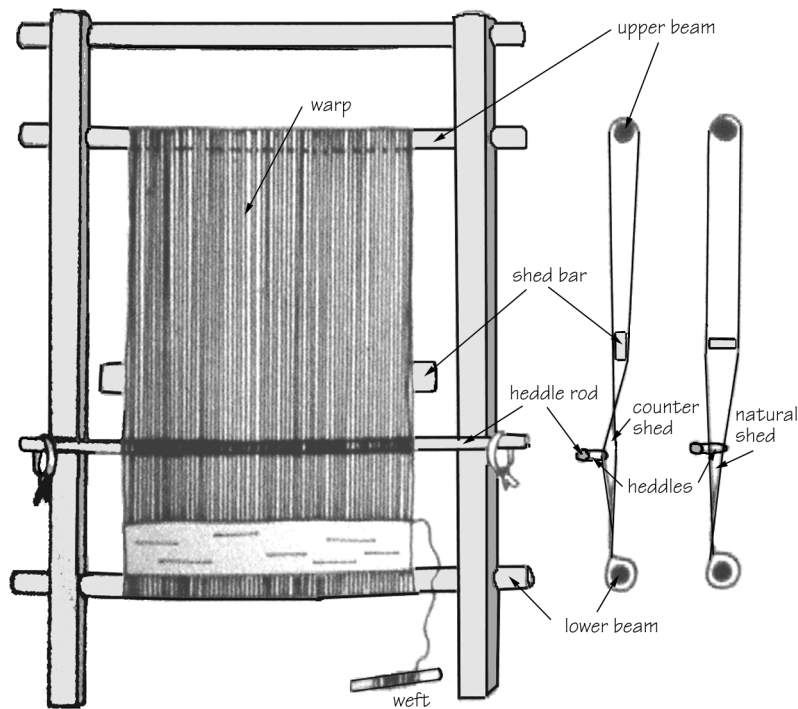
Figure 3. Mosaics of the Emperor Justinian (top) and the Empress Theodora (bottom) in the sanctuary of San Vitale, Ravenna. (540s). [from R. Cormack (2000), *Byzantine Art*, plates 33 & 34].



Figure 4. The garment depicted in this Egyptian painting (6th c., Antinoë) of Lady Theodosia bears a remarkable similarity to actual tunics found in Egypt, such as this tunic thought to be from Akhmîm. (Metropolitan Museum of Art, no. 26.9.8) is possibly 5th c. The scale and placement of the motifs and borders corresponds to the garments depicted in the mosaics of San Vitale, Ravenna, just visible under the royal regalia. [Painting from M-H. Rutschowskaya (1990), *Coptic Fabrics* (Paris: Adam Biro), p.51). Tunic from A. Stauffer (1995), *Textiles of Late Antiquity* (New York: Metropolitan Museum of Art), p.26.]



a. Simplified drawing of what is typically published as the Greek warp-weighted loom. From left to right: side views showing two sheds necessary for plain weave and tapestry; perspective view of the front of the loom.



b. Simplified drawing of the typical Egyptian two-fixed beam loom, as depicted in tombs from the mid-second millenium BCE forward. Side views show the two sheds necessary for plain weave and tapestry. Note that the length of weaving is dependent on the height of the loom. (See Fig. 11 for enlarged drawing of loom set-up).

Figure 5. Typical vertical looms found in the Eastern Mediterranean.

Byzantine Velvet

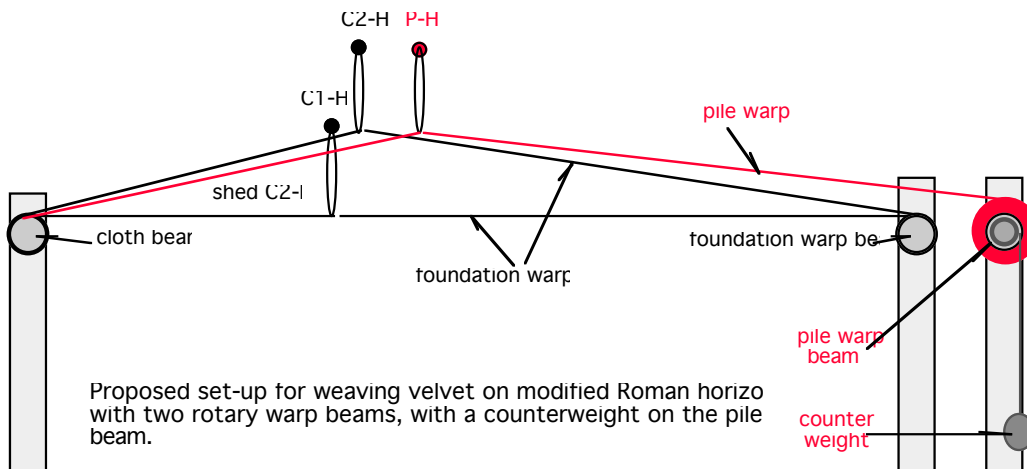
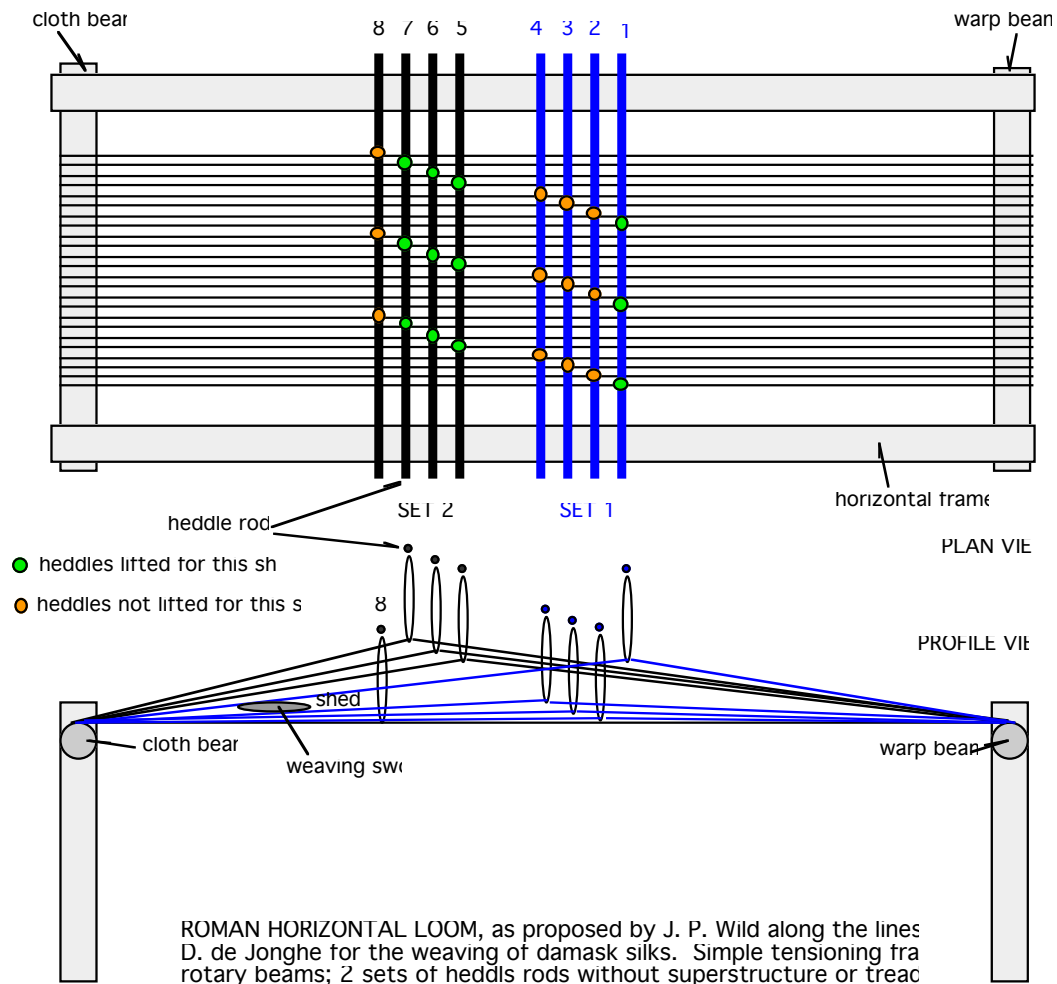


Figure 6. Top and side views of Roman horizontal loom, as proposed by J. P. Wild (1987), for weaving 3/1 twill damask (Fig. 2) in the first or second centuries. This loom could easily be adapted, as shown, for weaving velvet.

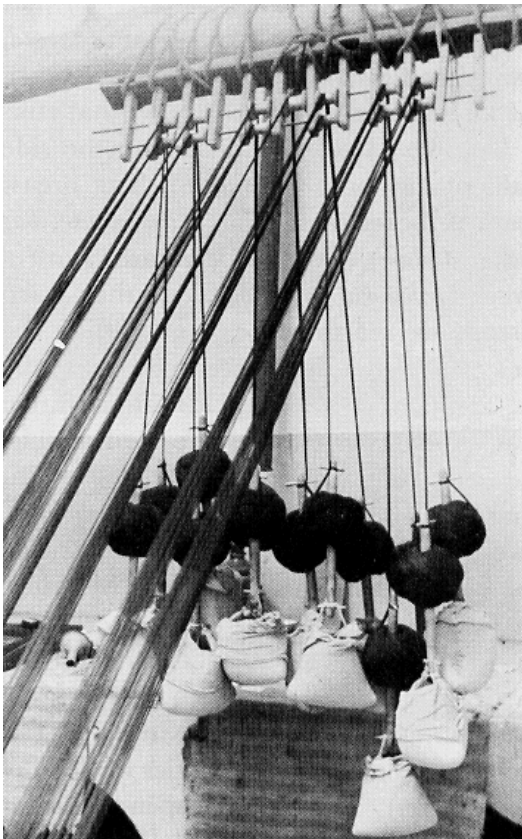
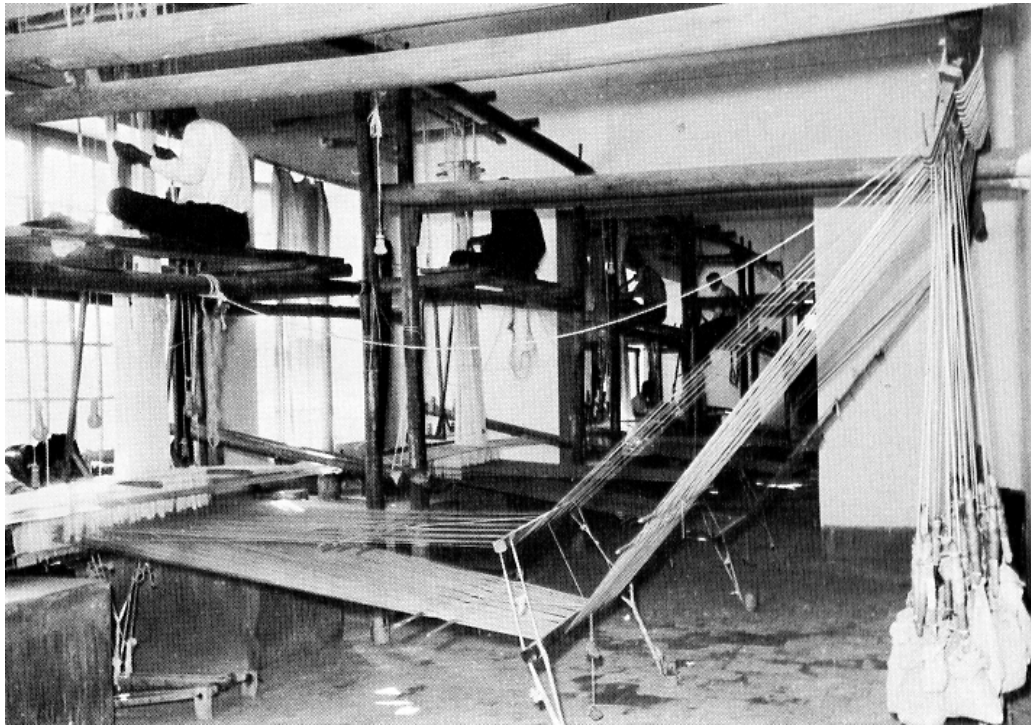


Figure 7. Traditional Persian warp-weighted drawloom, with two separate warps. [From H. E. Wulff (1966), figs. 284 (bot.) & 287 (top)].



Figure 8. V&A 682. Linen cut velvet with inset tapestry bands, 4th-5th c., Akhmîm. 40 x 11 cm. Described by Kendrick as the "double band from the cuff of a linen tunic faced with loops" (1920-22, vol.2, cat. no.302, p.10). Both selvages present. Collection of Victoria and Albert Museum, London.



Figure 9. V&A 691. Linen cut velvet with inset tapestry bands, 4th-5th c., Akhmîm. 21.5 x 19 cm. (see also Kendrick, 1920-22, vol.2, cat. no.303, p.11). Collection of Victoria and Albert Museum, London.



Figure 10. V&A 708. Linen cut velvet with inset tapestry square motif and shoulder band (clavus). 4th-5th c. Akhmîm. 69 x 24 cm. Selvedge present on one side (See also Kendrick, 1920-22, cat. no. 301, p.10, & plate I, p.109). Collection of Victoria & Albert Museum, London.

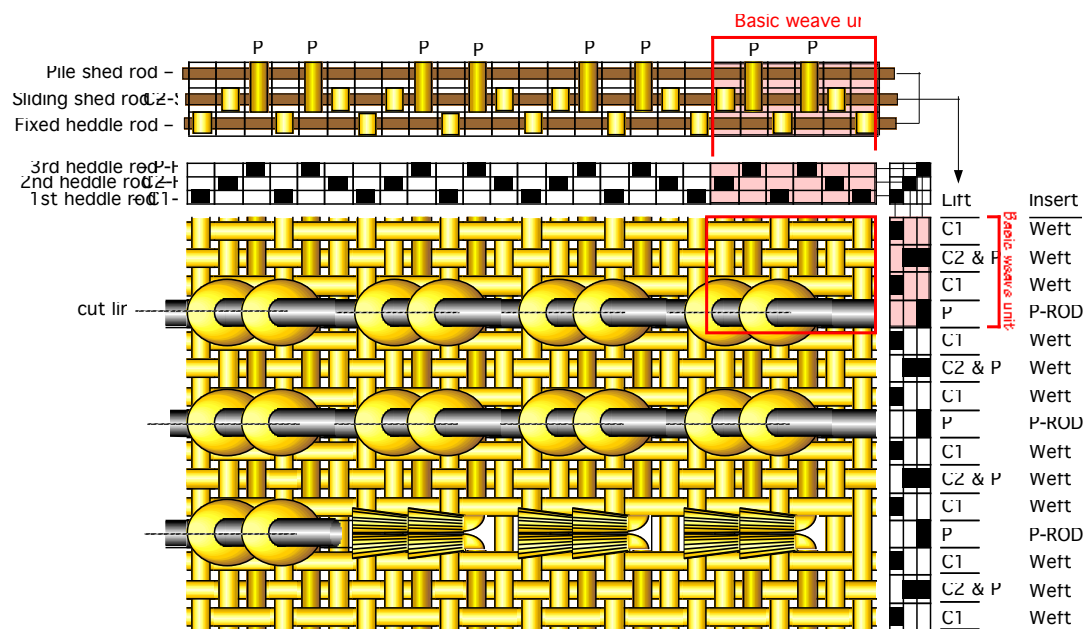


Figure 11. Diagram of velvet weave type 6w. Brown bars at top indicate fixed heddle / sliding rod set-up. Graph with black squares indicates 3-heddle rod set-up, with basic weave unit highlighted in pink, and outlined in red on drawing. P pertains to pile, C1 & C2 pertains to foundation cloth. Lift indicates which rods are lifted to form the shed (space) for each weft or pile rod (P-ROD).

Byzantine Velvet

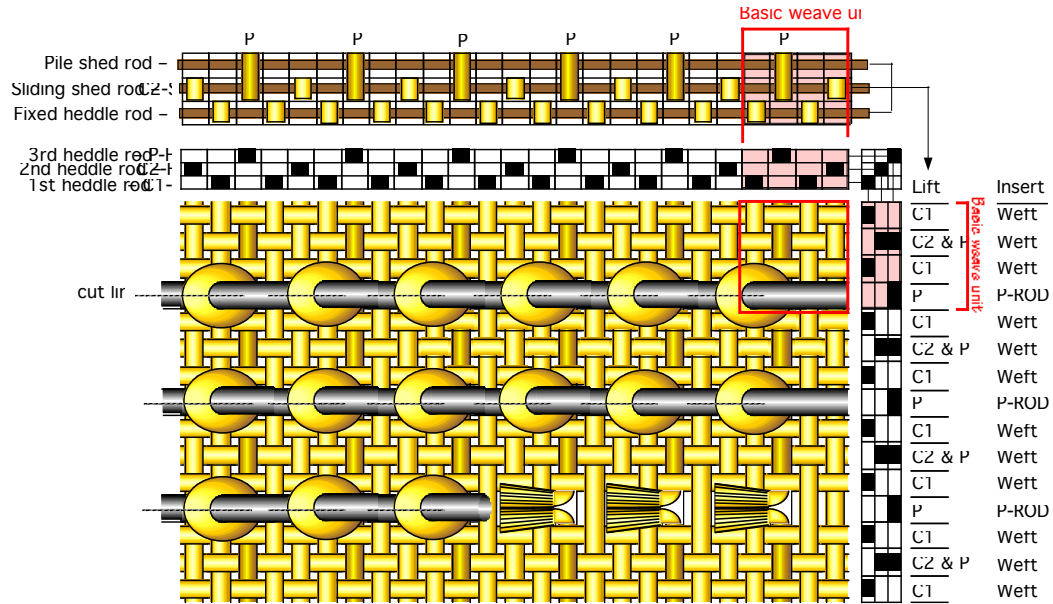


Figure 12. Diagram of velvet weave type 4w. Brown bars at top indicate fixed heddle / sliding rod set-up. Graph with black squares indicates 3-heddle rod set-up, with basic weave unit highlighted in pink, and outlined in red on drawing. P pertains to pile, C1 & C2 pertains to foundation cloth. Lift indicates which rods are lifted to form the shed (space) for each weft or pile rod (P-ROD).

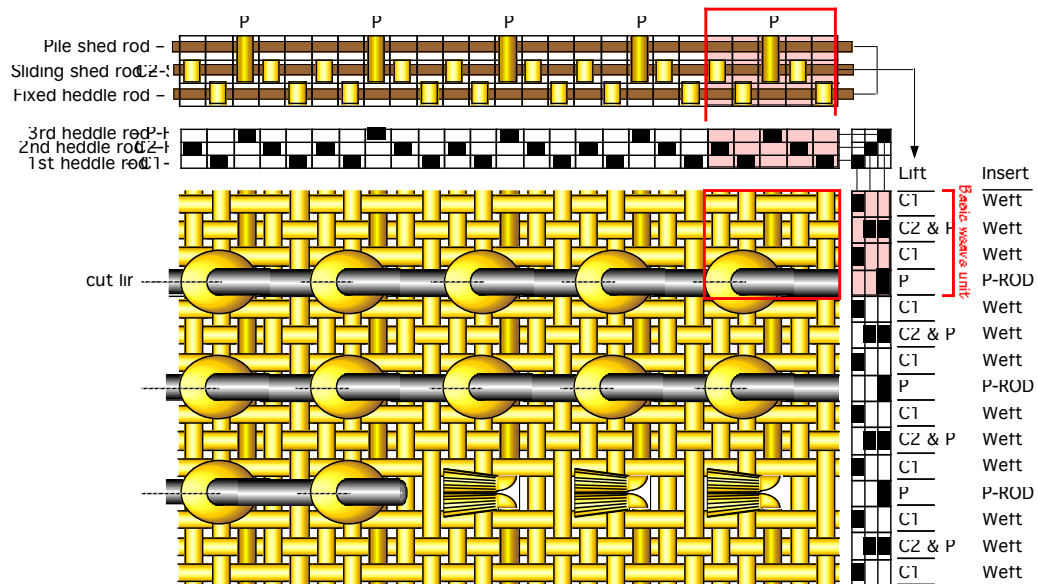


Figure 13. Diagram of velvet weave type 5w. Brown bars at top indicate fixed heddle / sliding rod set-up. Graph with black squares indicates 3-heddle rod set-up, with basic weave unit highlighted in pink, and outlined in red on drawing. P pertains to pile, C1 & C2 pertains to foundation cloth. Lift indicates which rods are lifted to form the shed (space) for each weft or pile rod (P-ROD).

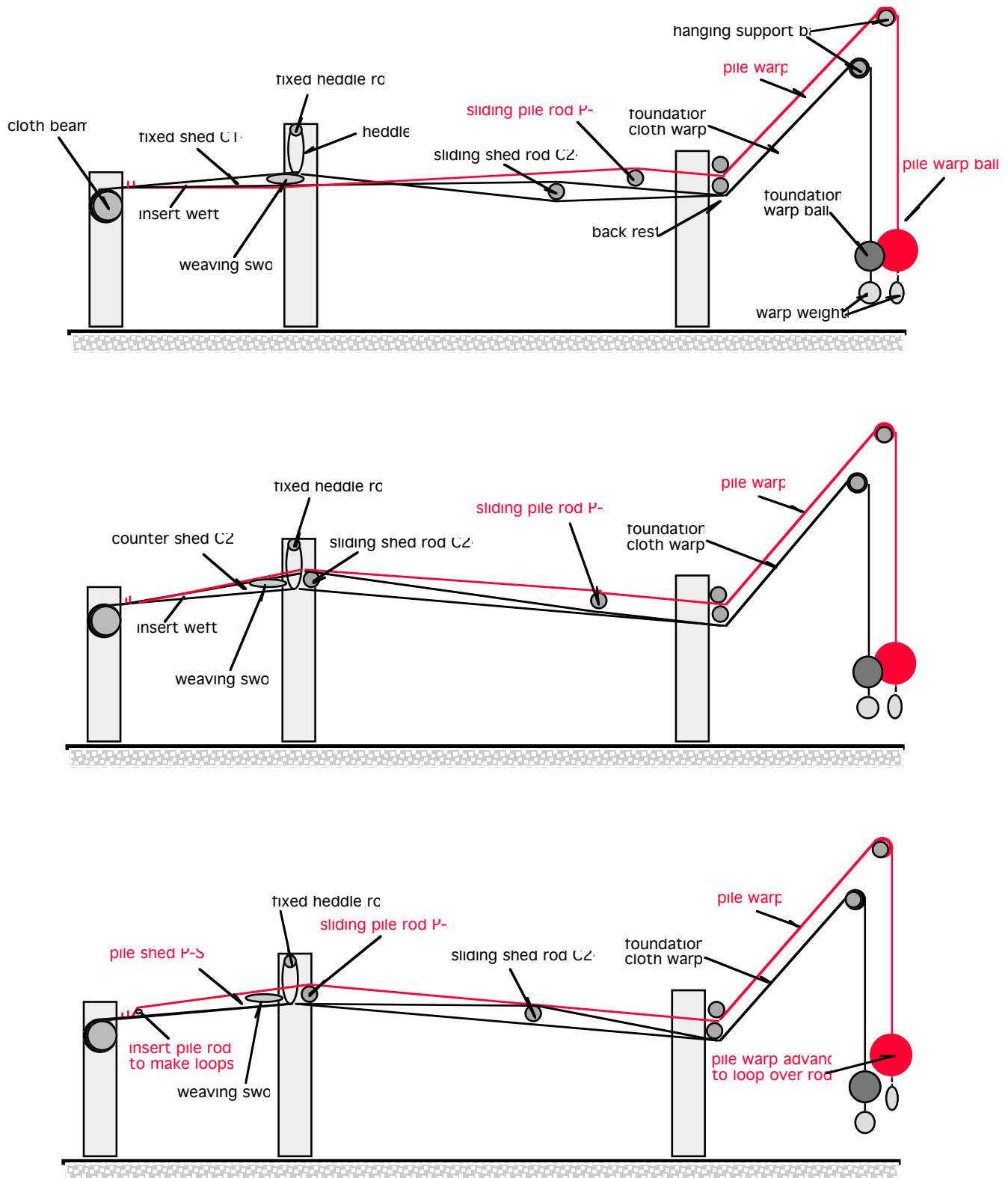
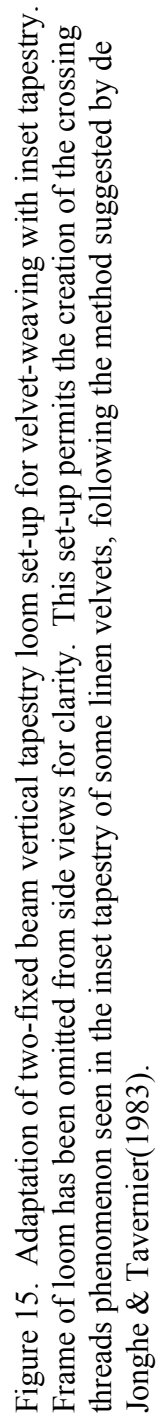


Figure 14. Adaptation of eastern horizontal warp-weighted loom set-up for velvet-weaving, using fixed heddle / sliding rod mechanism without superstructure or treadles. Top: fixed heddle shed C1-H; centre: sliding shed C2-S; bottom: sliding pile shed P-S.



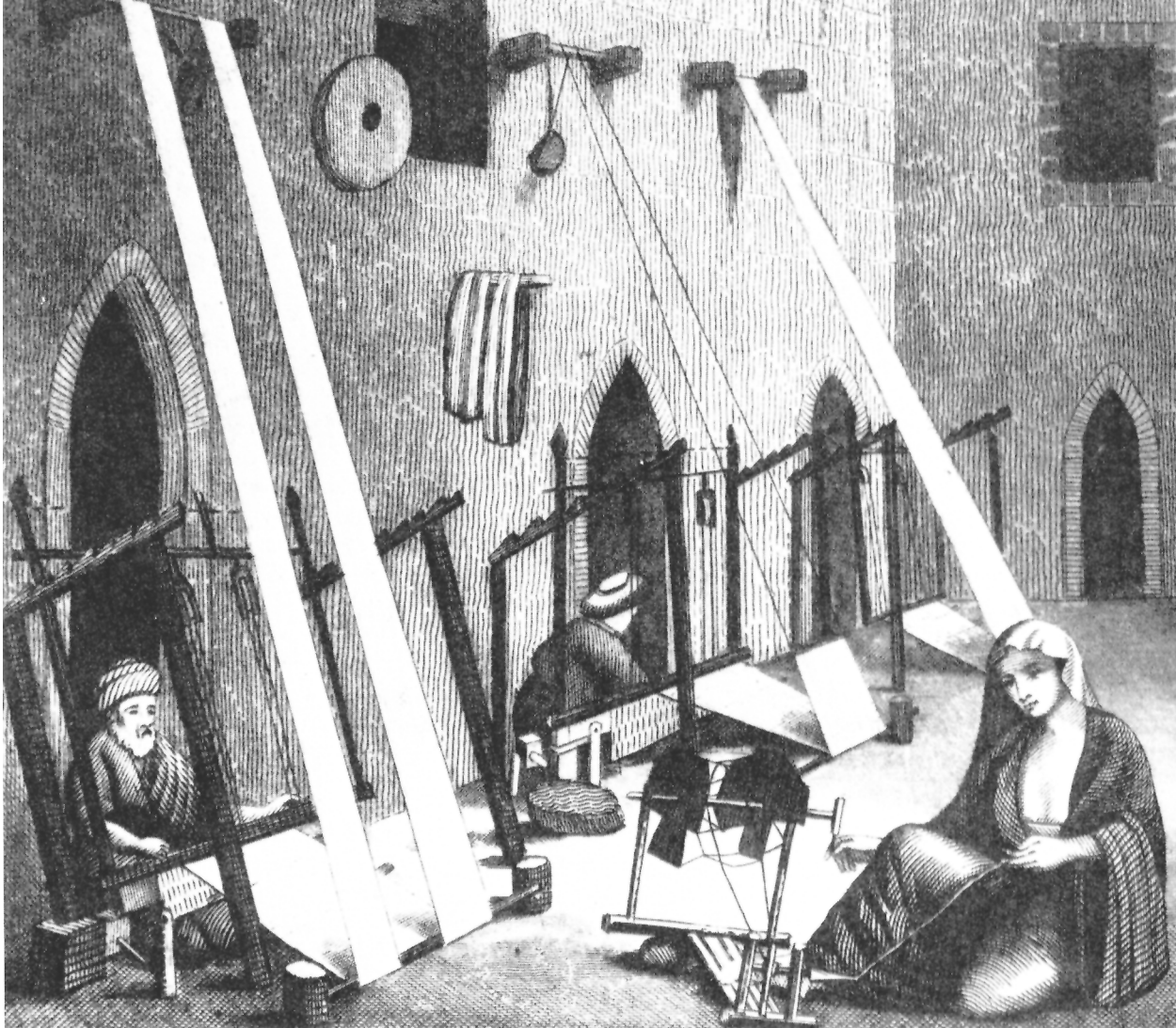


Figure 16. Space-saving Egyptian warp-weighted looms. A similar Syrian overhead weighting set-up is also reported at second-hand by Roth (1913/1978, p.42). [From E. Brody (1979), Fig.6-11, who cites Gilroy, *The History of Silk, Cotton, Linen, Wool and Other Fibrous Substances*, 1845.]

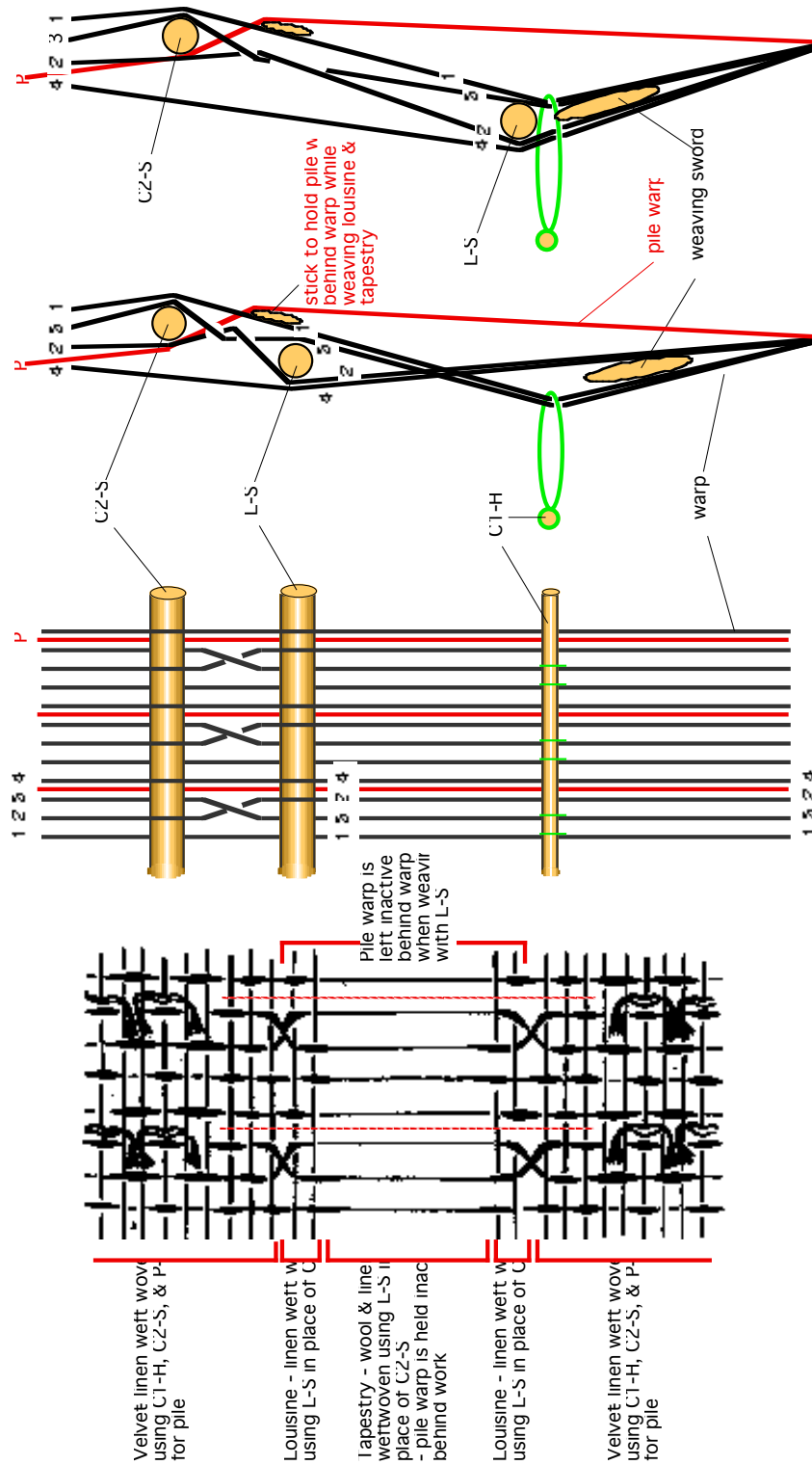


Figure 17. Diagram of the changes needed to weave inset tapestry motifs on the linen velvet background. Left: the structure of MHTL 24400/118, as analysed by G. Vial (1964). Right set: Simplified front and side views of the warp showing the insertion of the temporary tapestry shed rod L-S which will weave the *lousine* (basketweave) and incidently cause some warp threads to twist around each other. This crossing only appears at the beginning (when the lousine rod L-S is inserted) and the end (when L-S) is removed to resume weaving the velvet cloth. The pile warp threads are indicated in red. The weaving batten is inserted *after* each shed change, to press the preceding wefts into place and hold the shed open while working the tapestry.

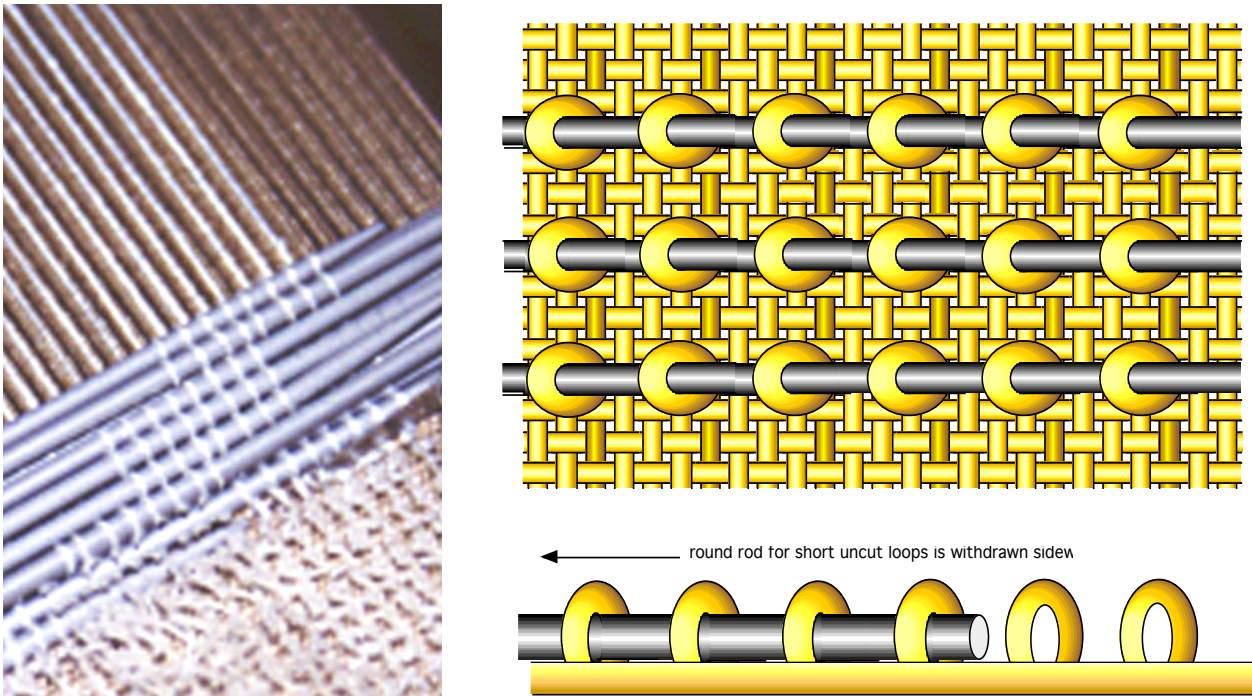


Figure 18. Photograph and diagrams showing views of round rods used to make small linen loops that remain uncut. Round rods are simply withdrawn out one side.

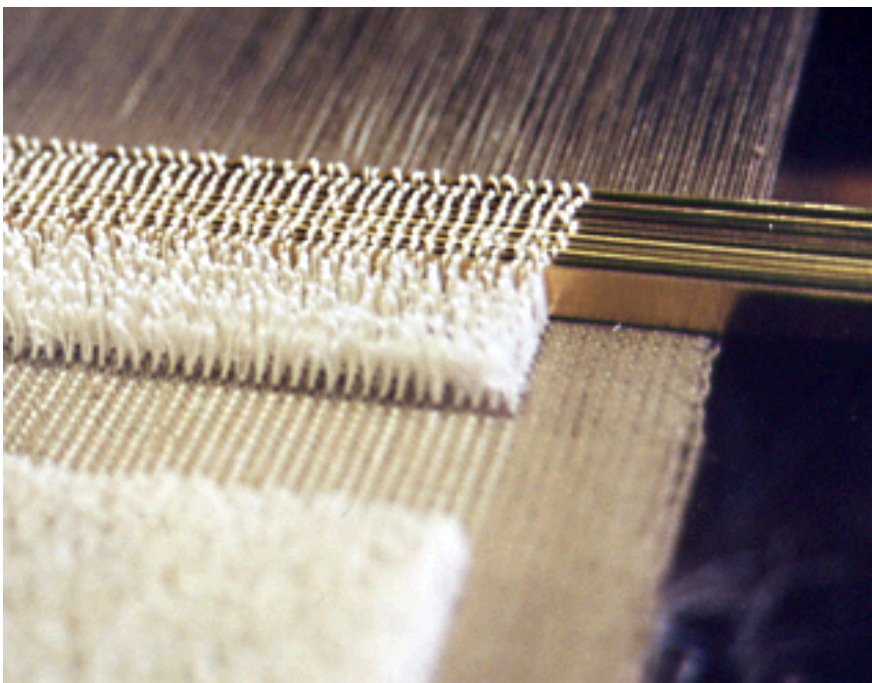


Figure 19. Photograph of flat bars, inserted in pairs on end, to form long loops which may be cut or left uncut.

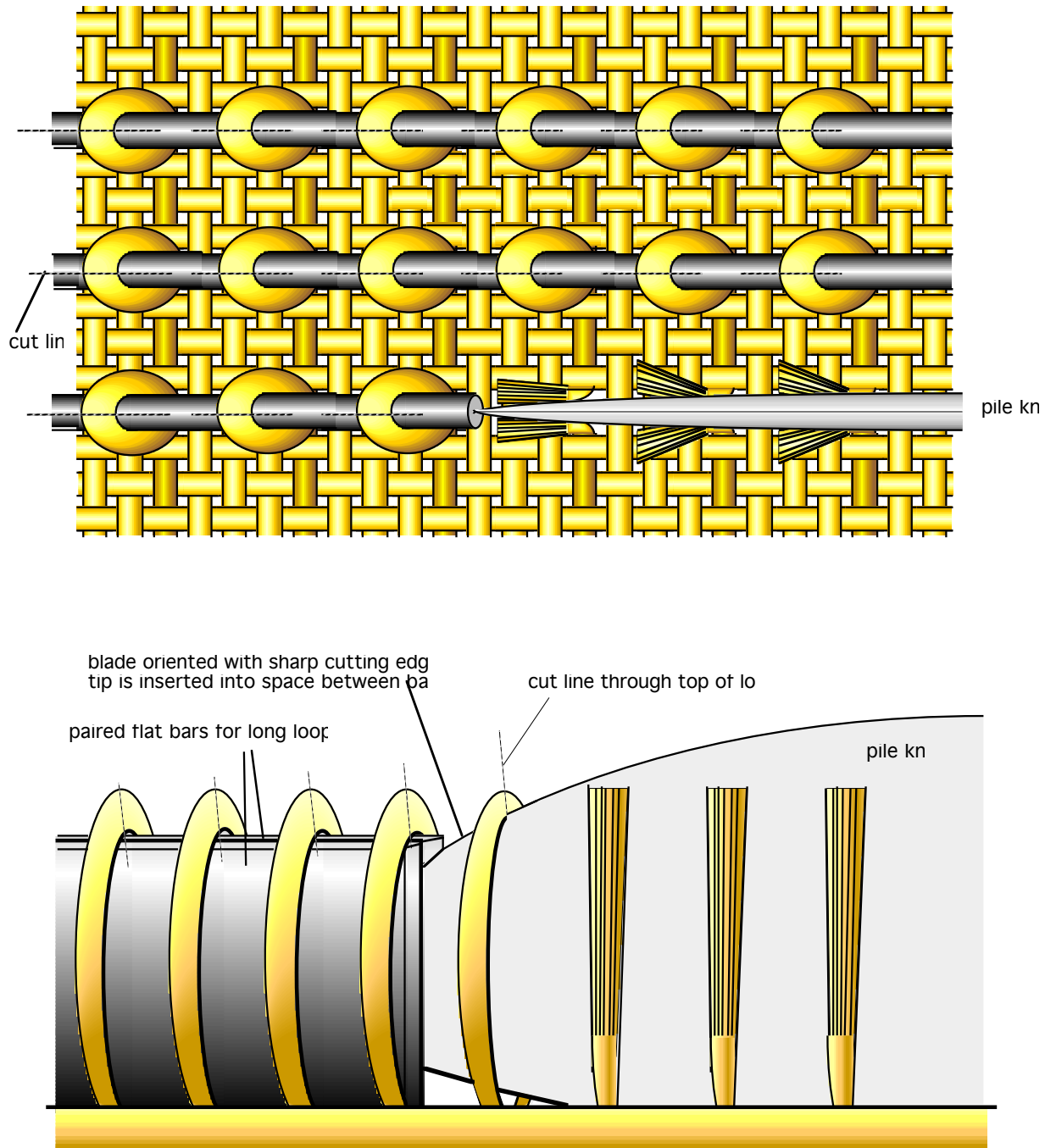


Figure 20. Diagram of process of cutting loops. Top: view of knife following path of rods as they are withdrawn out the opposite side. Sharp cutting edge of blade is oriented upwards. Bottom: side view of knife blade cutting. Tip of blade may be inserted between paired flat bars to guide the cutting. Loops gradually climb up the taper of the blade to cut cleaning at the top of the loop. Ideally, the knife is blunt along the base, and tapers up near the tip, to avoid cutting the foundation cloth.

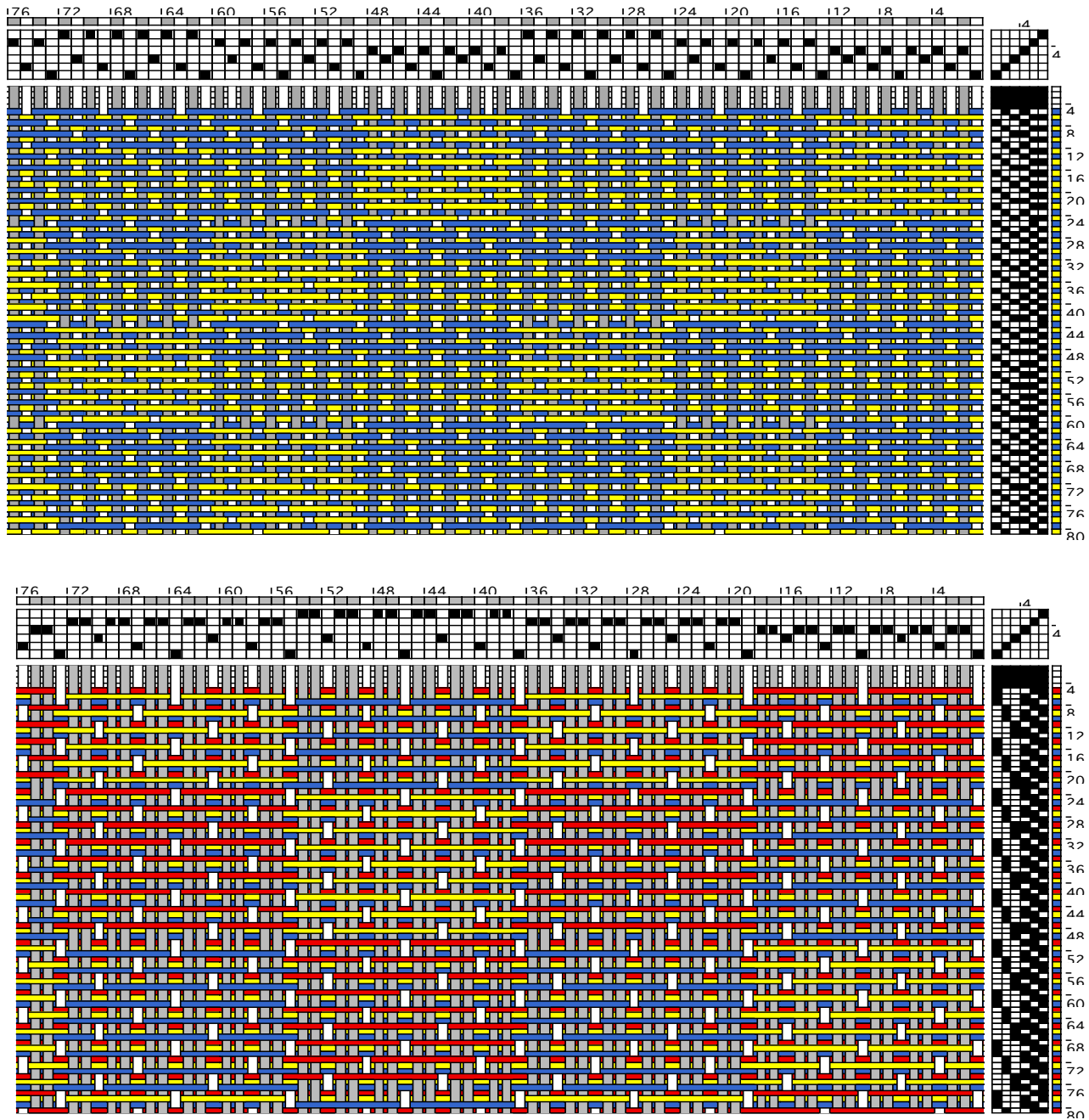


Figure 21. Weft-faced compound twills, also known as samite or *samitum*. The basic weave unit (outlined in blue, yellow, or red) of each *design* block of samite (with single main warps, top) is six (as in *hexamiton*). Doubling the main warps (shown in grey) does not change the overall structural principle or how it is set up. Design blocks are built of combinations of basic units; designs are built of combinations of design blocks. Top: 2 colour design. Bottom: 3 colour design.

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Appendix A

Glossary of Weaving Terms

<i>Batten, beater</i>	The tool or part of the loom with which the weaver pushes or beats the weft thread into place in the cloth.
<i>Comb</i>	May refer either to a heavy hand comb with shallow teeth used to beat tapestry wefts into place, or to a <i>raddle</i> or <i>reed</i> .
<i>Count</i>	The density of the threads across the surface. The warp is counted as ends per inch (epi) or ends per cm. The weft is counted as picks per inch (ppi) or picks per cm. Pile rows are counted as rows per inch (or cm.)
<i>Draft</i>	The drawing in of the threads, both on the loom and on paper. As a noun, <i>draft</i> refers both to schematic notation or drawings on paper of the weave plan, and to the ordering of the threads. As a verb, <i>draft</i> describes the act of designing the thread order and of drawing it on paper, as well as the act of drawing the warp threads in order through the shed (lifting) mechanism.
<i>Drawloom</i>	A type of loom with a complex two-harness shed mechanism to create elaborately figured woven cloths.
<i>Figured</i>	Figured cloths are patterned with elaborate designs which surpass the basic structural pattern. Visual designs are built up of contrasting design blocks of different or systematically varied weaves in combination, analogous to closely-aligned mosaic squares.
<i>Float</i>	A thread which floats free across the surface of the cloth over several threads.
<i>Foundation</i>	The basic structural cloth in which velvet pile threads or other supplementary ornamental weave floats are held. Also known as ground or ground cloth.
<i>Harness</i>	A grouped set of heddle rods or shafts in the shed mechanism that work together to manipulate a particular related segment of the weave structure. In two-harness systems, one harness (set) manipulates the foundation cloth structure, and the second harness (set) manipulates the warp threads that form the figuration of designs. In velvet, the second harness (set) manipulates the pile warp threads.
<i>Heddle</i>	The string loops or metal fittings on the loom through which the warp threads are passed and by means of which the warp threads are held in order and attached to the movement of the shaft.
<i>Heddle rod</i>	The rod to which the heddle string loops are attached. When lifted, all the warp threads which pass through the heddle loops attached to the rod are raised, creating a space known as the <i>shed</i> . The heddle rod(s) form all or part of the shed mechanism.
<i>Lease sticks</i>	A pair of sticks used to maintain the order of the warp threads, and to help to spread them out to the desired density behind the weaving. Lease sticks can also be used to help even out tension and to segregate groups of warp threads from each other for separate tensioning, as in two-warp systems like velvet or weft-faced compound weaves.
<i>Loom</i>	The combined assembly of frame that holds a set of threads under tension for weaving, and shed mechanism. Horizontal looms hold the warp threads being woven horizontally in front of the weaver; vertical looms hold the warp threads being woven vertically in front of the weaver. Warp-weighted looms hold the warp threads under tension with weights, stones, or bags of sand. Fixed beam looms hold the warp threads between two beams at a fixed distance from each other, one or both of which may rotate to store the excess warp or finished cloth.
<i>Nap</i>	The fuzzy surface of fabrics which have been brushed up or heavily agitated, usually woollens. Also refers to pile surface or to the direction in which the pile threads habitually lie.
<i>Plain weave</i>	The most basic weave structure. Each alternate thread is lifted, creating a simple over one, under one interlacement.
<i>Pile</i>	Loops or cut loops / ends of thread which stick out perpendicular to the plane of woven cloth backing. Woven piles are made by warp, weft, or knotted weaving techniques. Also used more generally to refer to similar surface textures, such as brushed (napped) woolen cloths, pile made

	on knitted foundations, or pile formed by embroidery stitching.
<i>Pile rod</i>	For velvet weaving, the pile rod is inserted to hold up the loops of warp threads until they are securely entrapped in the weave and unable to be pulled out by the tension of the warp weights. May be a round rod, or a flat bar raised on end.
<i>Raddle, spacer</i>	A comb or equivalent arrangement by which the warp threads may be spread to the appropriate density when installed on the loom, or maintained at an appropriate spacing (density) during weaving.
<i>Reed</i>	The comb through which the warp threads are passed to maintain a regular density and width. Used in front of the shed mechanism to beat the weft into place. The spacing of the spaces/teeth are closer than for a <i>raddle</i>
<i>Repeat</i>	The minimum threading or lifting sequence which is repeated.
<i>Samite</i>	Weft-faced compound twill weave cloth. The pattern weft threads are bound in a 1/2 twill weave (ie. an over 1, under 2 path over the pattern weft threads is followed by the warp threads).
<i>Satin</i>	The third basic weave structure which steps by a regular counter, but not to the next step, as does twill. It attempts to create a minimally visible random stitching down of threads to avoid the distinct twill diagonal line, and maximise the profile of longer thread floats.
<i>Shaft</i>	The frame of the harness on which the heddles are mounted and treadles sometimes attached, which lifts the threads up and down to form the weaving shed through which the weft (shuttle) passes.
<i>Shed</i>	The space created between the lifted threads and those which remain sunk, through which the shuttle is passed to carry the weft thread from one side of the cloth to the other.
<i>Shed rod</i>	A rod inserted into the warp threads to lift threads, instead of a heddle rod. May be combined with heddle rod(s) to permanently maintain a basic shed.
<i>Shed mechanism</i>	The mechanism by which warp threads are lifted (or pulled down) to create the shed space for entering the weft. May involve a combination of heddle rods and/or shed rods, or shafts.
<i>Shed sequence</i>	The order in which sheds are opened and wefts passed; ie. the order in which shafts, or combinations of shafts, are lifted.
<i>Supplementary</i>	Threads which are not part of the primary structural cloth. Supplementary threads can be pulled out of the cloth without destroying the structural stability of the cloth. The pile warp threads of velvets are supplementary to the foundation cloth.
<i>Sword</i>	A long, broad flat stick, which may be tapered along one edge, used to push or press the weft into place, at the desired density. May also be used to hold a shed open or give extra height to a shed while the weft is passed through. A type of beater.
<i>Tabby, taffeta</i>	The most basic weave structure. See <i>plain</i> weave.
<i>Taqueté</i>	Weft-faced compound tabby (plain) weave cloth. The pattern weft threads are bound in a plain weave (ie. an over 1, under 1 path over the pattern weft threads is followed by the warp threads).
<i>Treadle</i>	The foot-operated part of the loom to which the shafts are attached either singly or in combinations, by means of which the weaver lifts or pulls down the shafts to form the weave shed.
<i>Twill</i>	The second basic weave structure. Each successive weft intersection steps by one thread to the right or left, thus forming a distinctive diagonal line. A minimum of three threads is necessary to execute twills. Floats of two or more threads are always involved.
<i>Warp</i>	The set of threads which is mounted on the loom under tension.
<i>Warp (thread)</i>	Individual thread in the warp chain. When several individual strands side by side or twisted together are interlacing as one thread throughout the weave structure, they might also be called or diagramed as one. Also known as (warp) <i>end</i> .
<i>Warp-faced</i>	Weaves in which the warp threads dominate or show up more prominently on the surface of the cloth than do the weft threads. The weft threads may be completely hidden by the warp

	threads.
<i>Weave unit</i>	Also known as the basic weave unit. The minimum set of warp thread interlacements (or paths) which is repeated to create the weave structure.
<i>Web</i>	The woven cloth or the woven structure.
<i>Weight</i>	Any heavy bead, ring or other object used to provide the necessary tension for warp threads on warp-weighted looms or set-ups. May be added to looms with fixed or rotary beams to adjust for differences in tension across the warp that may accumulate during weaving.
<i>Weft (thread)</i>	The thread which is passed through the threads of the warp by means of the shuttle.
<i>Weft-faced</i>	Weaves in which the weft threads dominate or show up more prominently on the surface of the cloth than do the warp threads. The warp threads may be completely hidden, as in tapestry.